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ABSTRACT

This curriculum guide contains 12 units that provide the basic curriculum components required to develop lesson plans for the carpentry curriculum. The guide is not intended to be a complete, self-contained curriculum, but instead provides the teacher with a number of informational items related to the learning outcomes and allows the teacher flexibility to design instructional activities, select resources, and deliver instruction most appropriate for the learner and learning environment. The units of instruction contain the following components: learning outcomes; associated tasks; performance standards; lists of tools, equipment, resources, and limiting constraints; performance steps; and enabling objectives. The units cover the following topics: reading blueprints; selecting, purchasing, and storing material; cutting, shaping, and fastening; preparing building site; preparing concrete forms; framing floors; framing walls; framing roof and ceiling; installing roof; finishing exterior; finishing interior; and constructing stairs. A list of items to be included in a standard carpentry tool kit completes the guide. (KC)

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# VOCATIONAL EDUCATION CURRICULUM GUIDE

# INDUSTRIAL AND TECHNICAL EDUCATION

*Program Improvement Through*

C·B·V·T·E

*Competency Based Education*

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# CARPENTRY

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# CARPENTRY

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## Preface

The concept of competency based vocational-technical education has been supported by the Bureau of Vocational, Technical and Adult Education for a number of years. Since the early 1970's, the State has sponored the development and dissemination of numerous competency based curricula through the State Vocational Curriculum Laboratory. With the recent development of the State Master Plan for Public Education, however, the need to move rapidly toward systemwide adoption of this instructional concept in all schools is mandated by State Board of Education Policy.

According to the State Master Plan for Public Education, all instructional programs are to be learner oriented and described in terms of high quality, measurable, student centered outcomes (learning outcomes). In essence, this policy reinforces the competency-based vocational education philosophy.

Consistent with our current efforts in encouraging the implementation of vocational education learning outcomes, we have prepared this curriculum guide to assist vocational teachers as they prepare lesson plans that are reflective of the mandated core curriculum and defensible in terms of an equitable, quality vocational program.

Additional copies of this curriculum guide may be obtained from the:

West Virginia Vocational Curriculum Laboratory
Cedar Lakes Conference Center
Ripley, West Virginia 25271
Telephone: (304) 372-7021
Toll Free: 1-800-WVA-JOBS (in state)

Any suggestions you have for improving this material may be sent to your Vocational Curriculum Laboratory. Through this feedback, we plan to continually update and revise our materials.

VOCATIONAL, TECHNICAL AND ADULT EDUCATION

Clarence E. Burdette

Clarence E. Burdette
Assistant State Superintendent of Schools

## Overview

The contents of this guide provide the basic curriculum components required to develop lesson plans that address the learning outcomes for this particular area of study. As such, this guide is not intended to be a complete, self-contained curriculum. Instead, the teacher is provided a number of informational items related to the learning outcomes and allowed the flexibility to design instructional activities, select resources and deliver instruction most appropriate for the learner and learning environment.

Specifically, this curriculum guide is organized in the following manner:

### Units of Instruction (Where applicable)

A unit of instruction is a group or cluster of related learning outcomes that have been placed together for their similarity or main idea of task accomplishment. An example of a Unit would be Shielded Metal Arc Welding within the welding and cutting area of study.

### Learning Outcomes

A learning outcome, oftentimes synomous with a competency statement, is a concise description of the curriculum in terms of desired learner behavior. Such statements are measurable, may contain one or more tasks and be action oriented. All approved learning outcomes for vocational education have undergone a strigent verification process with input from teachers and representatives of the business and/or industrial sector.

The approved learning outcomes for a specific vocational education area of study represent the core competencies of what has been identified as a quality vocational education experience. They do not, however, represent the entire instructional program for any area of study. It is hoped that all vocational instructors and local educational agencies will provide learners with educational experiences that exceed the "core competencies" identified through the learning outcomes.

### Associated Tasks

A task represents an identifiable behavior that (1) has a purpose; (2) has a definite beginning and ending; (3) contains two or more steps none of which is a restatement of the original task statement if in the psychomotor domain; and (4) has a standard of performance which can be defined, described and verified. Learning outcome statements may be on the task level or may contain two or more independent tasks.

Examples of task/behavior statements are:

1. Chase external pipe threads.
2. Bleed diesel fuel system.
3. Use common standard medical abbreviations.
4. Prepare a resume.
5. Plan food experiences suitable for young children.

Performance Standards

The Standard is defined as criteria for assessing if tasks are performed or demonstrated as either acceptable or unacceptable. The performance standard communicates to the learner the quantity and quality of how well he or she is expected to complete the task. The standard can be stated in terms such as actual percentage of achievement, the accuracy expected, the number of errors permitted, the time allowed to complete the task, the degree, or any other appropriate level at which achievement is anticipated. The standard should be based on the performance level needed on the job.

Examples of standards are:

1. The circuit board must operate within the tolerances of the circuit design.
2. The estimate must be within + or -5% of that figured by the instructor.
3. Contacts must open when more than 125% of rated current value is made to pass through the overload relay heating element or coil.
4. The installation must be complete and each conductor must be terminated according to the schematic drawing of the design.
5. The motor must carry the load without being overloaded; the directions of rotation must be correct; belt must have a deflection of between 3/8" or 1/2".

Tools, Equipment, Resources and Situation(s)

Situation(s) is defined as the limiting constraints under which actions are to occur. The circumstances or restrictions imposed on the learner when he or she is demonstrating the behavior must be defined. Frequently, the conditions identify the testing situation used to determine learner achievement of the standard. Tools and equipment are the materials needed to perform the task being addressed in each performance standard.

Performance Steps

Performance steps are a series of steps required to perform a psychomotor task. The steps (1) are arranged in the sequence ordinarily followed on the job, (2) have a concise start and close, (3) are limited to the accompanying task statement, and

(4) are self-supporting and do not refer to actions beyond the task performance. Performance steps developed for each task are used to determine the enabling objectives and steps and procedures for performance checklist(s) to be utilized in assessing learner mastery of the task.

## Enabling Objectives

Enabling objectives reflect the knowledges, attitudes and related skills the learner must possess in order to complete the task to the specified standard(s). As such, enabling objectives are derived from an instructional analysis of the task and/or performance steps and are stated in measurable terms of student performance.

Terms such as "define verbally," "construct," "diagram" and "list" are used to express enabling objectives, rather than obscure verbs like "know," "learn" and "understand". Examples of acceptable enabling objectives are:

1. List verbally the parts of a voltmeter.
2. Define Ohm's Law.
3. Explain relevant safety precautions and procedures.
4. Discriminate between types of life insurance policies.

Given this information for each outcome statement, the instructor is encouraged to develop the following components for lesson planning, delivery and evaluation.

## Develop Instructional Activities

Instructional activities should be designed to provide the learner with experiences related to the enabling objectives, cumulating in successful task performance. The instructional activity section of a curriculum should contain a variety of strategies designed for the learners' varying learning styles and rates.

Consideration should be given to age, ability levels, educational levels, varied learning styles, individual interests, career goals, and emotional needs when developing the instructional activities. Activities should include suggestions for large groups, small groups and individual methods. The use of small groups may help students attain the skills, knowledge and attitudes associated with each task by making them (1) feel adequate and physically competent when they lack the necessary background information and experience; (2) feel a sense of security through the reenforcement of positive group attitudes; (3) gain confidence and discover that they are an essential part

of a team engaged in the learning-teaching process; (4) learn to work without direct supervision, and (5) vary instructional routines away from lecture or other full-class methods.

## Identify Appropriate Instructional Resources

Instructional resources should be identified for each instructional activity and should be designed to help convey the message of the task and enabling objective(s). Attempts should be made to utilize modern instructional technology (i.e. television, computers, videotapes, etc.) as much as possible in delivering the message desired. However, caution is advised in limiting the suggested resource section to only one alternative; due to the differing availability of resources between like programs across the state.

## Provide Instruction

Many misconceptions exist about how an individual teacher must manage the instructional process when utilizing the competency based approach. Oftentimes CBE is considered synonmous with individualized instruction, wherein the instructor becomes the instructional manager of the educational process instead of the more traditional view of the teacher. Such misconceptions have led many educators to renounce competency based education as a means by which the teacher loses control and direction over the instructional process and is relegated to merely a role of record keeper.

The underlying concept of competency based instruction, however, does not dictate specific instructional procedures and methodologies, but rather assures that those skills, knowledges and attitudes deemed essential for job success are taught, mastered to acceptable standards and documented. How this instruction is managed within the classroom, be it on a large group, small group or individualized basis should be left up to the instructor.

The content of the task itself and the enabling objectives dictate what should be taught. Thus, the instructional activities and supporting resources identified in the instructional plan must be designed to accommodate learner mastery of the subject matter. Where appropriate, this instruction may involve large group activities, smaller group participation and/or solely individualized study.

Where substantial diversity exists between ability and skill levels of the learners within a class, arrangements should be made to structure learning activities that accommodate this difference. This type of instructional arrangement is particularly crucial, given that one of the major premises of competency based instruction is that the learner be allowed to progress at his/her own pace and that this progression be based upon successful mastery of sequential competencies.

Also, another major consideration that must be given to providing competency-based instruction is the development of a mechanism whereby learners, due to prior experience or instruction, be allowed to "test out" on skills already attained without undue duplication of effort. This situation is most often addressed through the use of pretests prior to formal instruction.

*Evaluate Learner Performance

Evaluation of learner performance is one of the most critical steps in the instructional process. Criterion-referenced evaluative measures are advocated over the traditional norm-referenced approach due to the importance of all learners being able to perform to specialized standards. As such, the evaluation of learning outcomes and their related tasks should include means of assessing learner mastery of the knowledges, attitudes, and skills outlined in the enabling objectives and regarded as essential for completion of the learning outcomes/tasks, and also, learner performance of the learning outcomes/tasks to the performance standard.

In order to adequately evaluate learners, consideration must be given to constructing testing situations that address any or all of the three domains of learning encompassed within the learning outcome or task (i.e., psychomotor, cognitive, and affective).

*Note: The Bureau of Vocational, Technical and Adult Education is currently in the process or has developed comprehensive test item banks (written and performance) for a number of vocational education areas of study. For information relative to the availability of these item banks, contact the Assistant Director, Curriculum and Personnel Development.

Guide Coding System

Example: 4.2.3

4. - unit designation
2. - learning outcome under unit
3 - task under learning outcome

VOCATIONAL EDUCATION CURRICULUM GUIDE

CARPENTRY

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**PROGRAM OF STUDY:** **INDUSTRIAL AND TECHNICAL EDUCATION**

**AREA OF STUDY:** **CARPENTRY**

**UNIT: 1** **READING BLUEPRINTS**

**LEARNING OUTCOME:**

1.1 Identify architectural building symbols.

**TASK:**

1.1.1 Identify architectural building symbols.

**PERFORMANCE STANDARD:**

Architectural building symbols for doors and windows; installed equipment and fixtures; kitchen, bath, and other cabinets; appliances; chimneys, and fireplaces; plumbing, electrical, and air-conditioning/heating systems and lines; and building materials must be identified.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Plans and specifications.

**PERFORMANCE STEPS:**

Not Applicable

**ENABLING OBJECTIVES:**

1. Reference the American Institute of Architects (AIA) symbols for residential and light commercial construction.
2. Explain why identifying building symbols are essential for accuracy in any construction project.
3. Explain the difference between plan, elevation, and detail views.
4. Explain the difference between architectural symbols and dimensions.
5. Describe the components of residential or light commercial blueprints.
6. Sketch common architectural building symbols.

**UNIT: 1** **READING BLUEPRINTS**

**LEARNING OUTCOME:**

1.2 Determine dimensions from a blueprint.

**TASK:**

1.2.1 Determine dimensions from a blueprint.

**PERFORMANCE STANDARD:**

Dimensions must be determined from print or plans and must be transferred accurately to cutting bill.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Plans and specifications

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Identify dimension lines and notations on plans.
3. Determine scale of drawing for dimensions not specified:
   a. Measure distance.
   b. Multiply reading by scale.

**ENABLING OBJECTIVES:**

1. Define dimensions.
2. Identify various methods for indicating dimensions on a residential or light commercial blueprint.
3. Describe the procedure for determining size of material, length, and spacing from a blueprint.
4. Reference AIA materials regarding dimensions on architectural plans.
5. Sketch floor plans and note dimensions.

**UNIT: 1 READING BLUEPRINTS**

**LEARNING OUTCOME:**

1.3 Interpret building specifications.

**TASK:**

1.3.1 Interpret building specifications.

**PERFORMANCE STANDARD:**

Building specifications must be interpreted and transferred to specifications sheet. Grades of framing and finish lumber must be determined. Conflicting information between specifications and drawings must be noted.

**TOOLS, RESOURCES, EQUIPMENT,AND SITUATION(S):**

Local building codes, plans and specifications, zoning regulations.

**PERFORMANCE STEPS:**

1. Compile list of specifications from plans.
2. Compare specifications list with local building code requirements.
3. Compare specifications list with zoning regulations.
4. Correct specifications and plans to comply with local building codes and zoning regulations.

**ENABLING OBJECTIVES:**

1. Define specifications.
2. Identify grades of lumber for framing and finishing.
3. Identify the main purposes of specifications.
4. Explain how to make changes on an original plan.
5. Sketch examples of building specifications.

**UNIT: 2 SELECTING, PURCHASING, AND STORING MATERIAL**

**LEARNING OUTCOME:**

2.1 Select lumber and material for framing and finishing.

**TASK(S):**

2.1.1 Select lumber for framing.
2.1.2 Select lumber and material for finishing.
2.1.3 Select concrete.
2.1.4 Select concrete block.

**TASK:**

2.1.1 Select lumber for framing.

**PERFORMANCE STANDARD:**

Type, size, grade, and amount of dimensioned lumber and plyboard must be determined with 10% extra included for waste. Types, sizes, and amounts of fasteners and other necessary materials must be listed.

**TOOLS, RESOURCES, EQUIPMENT, SITUATION(S):**

Plans and specifications

**PERFORMANCE STEPS:**

1. Read plans and specifications.
2. Determine size and number of rough framing members from plans and specifications.

<u>For plates</u>

a. Determine length of each foundation wall in linear feet.
b. Round upward to even feet.
c. Determine nominal length required.
d. Total linear feet for common plate sizes.
e. Divide nominal size into total footage for number of lengths required.
f. Record calculations.

<u>For joists and rafters</u>

a. Determine length of member.
b. Round upward to even feet.
c. Count number of required lengths.
d. Double number of lengths for joists under partitions and around stairwells.
e. Total number of lengths required.
f. Determine materials for all sizes of joists and rafters.
g. Record calculations.

<u>For joist bridging</u>

a. Determine size and spacing of bridging from plans.
b. Determine linear footage of one length of bridging between joists.
c. Round upward to even feet.
d. Determine total linear feet of bridging required.
e. Determine materials for all sizes of bridging.

<u>For studs</u>

a. Determine size and spacing of studs from plans.
b. Calculate perimeter of exterior walls.
c. Determine number of studs required to frame exterior walls adding an additional fifteen percent for bracing, corner posts, etc.
d. Record total number of studs by length required for exterior walls.
e. Round upward to even feet.
f. Total linear feet of interior wall partitions.
g. Determine number of studs required to frame interior walls adding an additional fifteen percent for bracing, corner posts, etc.
h. Round upward to even feet for each size of stud.
i. Record total number of studs by length required for

interior walls.
j. Add totals for exterior and interior studs by length.

For trusses

a. Determine size and pitch of roof from plans and specifications.
b. Calculate sizes and number of trusses.
c. Total number of trusses by size and type.
d. Record calculations.

For headers

a. Determine width of all rough openings to receive headers from plans and specifications.
b. Determine lengths required.
c. Round upward to even feet for each length.
d. Total number of members by lengths.
e. Record calculations.

For bracing and blocking

a. Determine lengths of members required from plans and specifications.
b. Total linear feet of blocking and bracing.
c. Record calculations.

For plywood

a. Determine sizes, grades, and types of plywood required from plans and specifications.
b. Determine lengths and widths of each surface to receive plywood rounding upward to even feet.
c. Multiply length by width of each surface to determine square footage (area).
d. Multiply length by width of single plywood sheet to obtain square footage of unit coverage.
e. Divide square footage of each surface area by square footage of one plywood sheet to determine number of sheets required for each surface.
f. Determine total number of sheets of plywood by size, grade, and type of sheeting.
g. Record calculations.

3. Record calculated estimates

**ENABLING OBJECTIVES:**

1. Explain notations and symbols on plans and specifications for framing lumber.
2. Identify lumber by actual and nominal sizes.
3. Identify lumber and plyboard by grades.

4. Solve mathematical problems involving percentages.
5. Identify defects in dimensioned lumber and plyboard.
6. Describe the procedure for selecting lumber and materials for framing.

**UNIT: 2 SELECTING, PURCHASING, AND STORING MATERIAL**

**LEARNING OUTCOME:**

2.1 Select lumber and material for framing and finishing.

**TASK:**

2.1.2 Select lumber and material for finishing.

**PERFORMANCE STANDARD:**

Type, size, and quantity of dimensioned lumber, molding, and wall covering material must be determined with 10% extra included for waste. Types, sizes, and quantities of fasteners and other necessary materials must be listed.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Plans and specifications.

**PERFORMANCE STEPS:**

1. Read plans and specifications.
2. Determine sizes and amount of finishing material.

ROOFING

<u>For sloped roof</u>

a. Record paper, required insulation and roofing materials in squares.
b. Determine linear feet of hips and ridge.
c. Determine linear feet of valleys for flashing.
d. Measure linear feet of gutters and downspouts.
e. Count roof vents by size.
f. Count roof stacks by size.
g. Record calculations.

<u>For flat roof</u>

a. Record vapor barriers, insulation, and roofing materials in squares.
b. Determine length of abutting walls.
c. Determine length of parapets or roof edges.
d. Count number of roof penetrations and roof openings.

e. Record required quantities of cants, cap and base flashing, copings, fascia, penetrations, and roof accessories.
g. Record calculations.

INTERIOR UNDERLAYMENT

a. Determine length of floor in feet.
b. Determine width of floor in feet.
c. Round measurements upward to even feet.
d. Multiply length by width to determine square footage (area) of floor surface.
e. Multiply length by width of single underlayment sheet specified to obtain square footage (area) of unit coverage.
g. Divide floor area by square footage of one sheet of underlayment to determine total number of sheets.
h. Round figure upward to nearest full sheet.
i. Record calculations.

INTERIOR PANELING

a. Determine length of walls in feet.
b. Determine height of walls in feet.
c. Round measurements upward to even feet.
d. Multiply length by height to determine square footage (area) of wall surface.
e. Determine length and width of paneling.
f. Multiply length by width of paneling to determine square footage (area) of unit coverage.
g. Divide wall area by unit coverage to determine number of panels.
h. Record calculations.

STAIRWAY MATERIAL

<u>For wood stairways</u>

a. Determine length of one stringer.
b. Multiply length by 2 for footage of stringers.
c. Determine vertical rise in inches.
d. Determine number of treads and risers.
e. Determine length of hand rails.
f. Determine number and length of balusters.
g. Record calculations.

<u>For metal pan stairs</u>

a. Determine number and size of stairways required.
b. Estimate concrete.
c. Determine number, size, and materials of tread coverings, riser covering. platform coverings,

handrails, and balusters.
d. Record estimates according to grade, type, and size of materials.
e. Record calculations.

DOORS AND JAMBS

a. Check plans and specifications and/or door schedule.
b. Determine sizes and types of materials required.
c. Count number of doors.
d. Group doors according to size and composition.
e. Multiply number of doors by 14 to determine linear footage of jamb leg material.
f. Add widths of all rough openings to determine linear footage of jamb header material.
g. Record calculations.

CABINETS - PREFABRICATED

a. Lay out floor and wall plan of cabinets according to plans and specifications.
b. Determine dimensions of cabinet spacers required including allowances for drawer, door openings, windows, etc.
c. Count number of base and wall cabinets.
d. Count required accessories by size and type.
e. Determine linear footage of countertops.
f. Record cabinet and accessory estimates by size, style, type, and quantity.
g. Record calculations.

CLOSET ACCESSORIES

a. Determine length of closet.
b. Determine number of shelves from specifications.
c. Determine number of closet rods from specifications.
d. Multiply number of shelves by length of closet to determine linear feet of shelving.
e. Calculate support materials necessary for one of the following support methods:
    (1) Bracket supports:
        (a) Allow one bracket support per 24 inches of shelving.
    (2) Trim supports:
        (a) Add 3 feet to each closet length.
        (b) Multiply total by number of shelves per closet.
        (c) Calculate total linear feet of shelving for all closets.
f. Record calculations.

FINISHING HARDWARE

a. Determine hardware needs for:
   (1) Passage latch sets
   (2) Passage lock sets
   (3) Keyed entrance locks
   (4) Mortise locks
   (5) Deadbolts
   (6) Cabinet pulls
   (7) Hinge sets.
b. Note any variations in size and style.
c. Record total number of each type of hardware required.
d. Record calculations.

ACOUSTICAL CEILING MATERIAL

a. Determine length and width of ceiling area.
b. Multiply length by width to determine square footage (area) of ceiling area.
c. Multiply length by width of single acoustical tile to determine square footage (area) of unit coverage.
d. Divide total surface area of ceiling by square footage of one acoustical tile to determine total number of tiles.
e. Calculate linear footage of furring strips required in accordance with specified tile size and run of overhead joists.
f. Record calculations.

WINDOWS

a. Count windows.
b. Group windows according to sizes and style.
c. Record calculations.

SIDING

a. Determine length and height of wall.
b. Multiply length by height to determine square footage (area) of wall surface.
c. Determine length and width of siding (panel or board).
d. Multiply length by width to determine square footage (area) per unit of material.
e. Divide square feet of wall surface by square feet of one material unit to determine quantity needed.
f. Record calculations.

3. Record calculated estimates.

ENABLING OBJECTIVES:

1. Identify interior and exterior finishing materials.

2. Solve mathematical problems involving percentages.
3. Identify defects in finishing materials.
4. Describe the procedure for selecting lumber and materials for finishing.
5. Explain the necessary safety precautions.

**UNIT: 2 SELECTING, PURCHASING, AND STORING MATERIAL**

**LEARNING OUTCOME:**

2.1 Select lumber and material for framing and finishing.

**TASK:**

2.1.3 Select concrete.

**PERFORMANCE STANDARD:**

Volume of concrete must be in cubic yards, with no more than a two and one half percent waste allowance or within permissible allowance of specified order and class of job.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Plans and specifications

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Determine length of form(s) in feet or fractions of one foot.
3. Determine width of form(s) in feet or fractions of one foot.
4. Determine depth of form(s) in feet or fractions of one foot.
5. Multiply depth by width by length.
6. Convert to cubic yardage by dividing by 27.
7. Record calculations.

**ENABLING OBJECTIVES:**

1. Explain the notations and symbols on the plans and specifications for concrete.
2. Explain the procedure for determining concrete in cubic yards.
3. Define waste allowance.
4. Explain the importance of waste allowance.

UNIT: 2 SELECTING, PURCHASING, AND STORING MATERIAL

LEARNING OUTCOME:

2.1 Select lumber and material for framing and finishing.

TASK:

2.1.4 Select concrete block.

PERFORMANCE STANDARD:

Quantity of concrete blocks must be of dimensions specified on plans and specifications with no more than three percent waste allowance or within permissable allowance of specified order and class of job.

TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):

Plans and specifications

PERFORMANCE STEPS:

1. Determine dimensions of blocks required from plans.
2. Determine length in feet.
3. Determine height from plans.
4. Multiply length by height to determine square footage (area) of wall.
5. Determine area of openings in wall.
6. Subtract area of openings from area of wall.
7. Multiply wall area by 1.125 (for standard hollow core or solid blocks) to determine number of pieces.
8. Calculate wall areas for each thickness of blocks.
9. Total number of blocks for each wall area by thickness.
10. Record calculations.

ENABLING OBJECTIVES:

1. Explain the notations and symbols on the plans and specifications for concrete block.
2. Explain the procedure for determining square footage.
3. Explain the difference between hollow core and solid concrete blocks.
4. Explain how to calculate the wall areas for each thickness of block.

UNIT: 2 SELECTING, PURCHASING, AND STORING MATERIAL

LEARNING OUTCOME:

2.2 Complete a material list and estimate material cost.

**TASK:**

2.2.1 Complete a material list and estimate material cost.

**PERFORMANCE STANDARD:**

The list must include size, quantity, grade, and type of lumber and materials required to build the structure. Final figures must be with 5% of predetermined totals.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Plans and specifications

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Create a worksheet.

| Item | Quantity | Unit Cost | Total Cost |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

3. List all material to be purchased.
4. Obtain unit cost figures from catalog/dealer/supply house.
5. Add total cost column.

**ENABLING OBJECTIVES:**

1. Solve mathematical problems involving addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals.
2. Identify information need to complete a material list.
3. Describe how to use catalog indexes.
4. Identify technical terms relevant to building trade.
5. Reference pricing information from lumber companies, hardware stores, and builder supply houses.
6. Explain the methods for calculating cost per linear foot, board foot, and square foot.

**UNIT: 2 SELECTING, PURCHASING, AND STORING MATERIAL**

**LEARNING OUTCOME:**

2.3 Stack lumber and store building material.

**TASK:**

2.3.1 Stack lumber and store building material.

**PERFORMANCE STANDARD:**

The dimensioned lumber must be stacked securely by type, grade, and size. All building materials must be stored safely to prevent falling, damage to the materials, and fire. All materials must be easily accessible.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Even site, stock, tarpaulins

**PERFORMANCE STEPS:**

1. Place scraps of stock evenly on ground to raise pile off surface.
2. Stack boards in reverse order of usage with stock to be used first on top of pile.
3. Cover all stock with tarpaulins to protect from weather.

**ENABLING OBJECTIVES:**

1. Explain how to organize storage areas for best use of space and easy access to stored materials.
2. Identify hazards involved in stacking and storing materials.
3. Explain how to inventory materials in storage and rotate stock.
4. Explain the necessary safety precautions.
5. Identify common sizes of dimensional lumber.
6. Identify the types and sizes of nails.
7. Identify building materials effected by heat.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.1 Cut stock to size.

**TASK:**

3.1.1 Cut stock to size.

**PERFORMANCE STANDARD:**

The stock must be cut to specification (+ or -) 1/16 inch for length and width; angles must be cut to specification (+ or -) 2 degrees.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, joiner, plans and specifications, saws, thickness planes

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Select stock.
3. Determine types of cuts required.
4. Select equipment for required cutting/milling.
5. Perform cutting operation.
6. Check finished workpiece against measurements specified in plans.

**ENABLING OBJECTIVES:**

1. Explain how to read a rule.
2. Solve mathematical problems involving addition and subtraction of whole numbers.
3. Solve mathematical problems involving addition and subtraction of fractions.
4. Identify the parts of a circular saw or table saw.
5. Explain how to adjust a circular saw or table saw to different angles.
6. Explain how to use and maintain a circular saw or table saw.
7. Describe the procedure for cutting sheet stock (plywood or particleboard) to size.
8. Explain the necessary safety precautions.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.2 Cross cut and rip saw dimensional lumber to size.

**TASK:**

3.2.1 Cross cut and rip saw dimensional lumber to size.

**PERFORMANCE STANDARD:**

The lumber must be cut across the grain to specifications (+ or -) 1/16", and edges must be free of chips and splinters. The lumber must be cut with the grain to specifications (+ or -) 1/16", and edges must be free of chips and splinters.

**TOOLS, RESOURCES, EQUIPMENT, ANDSITUATION(S):**

Standard tool kit, plans and specifications, portable power saw and blades, stock

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Select and lay out stock to specifications.
3. Select blade for cut being performed.
4. Secure work piece in holding device.
5. Set depth of blade.
6. Position and feed saw along scrape side of layout line.
7. Remove splinters or rough edges with abrasive paper, if required.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify various sizes of dimensioned lumber.
3. Identify combination and crosscut saw blades.
4. Explain how to lay out a crosscut on dimensioned lumber.
5. Describe the procedure for crosscutting dimensioned lumber with a circular saw or radial arm saw.
6. Identify combination and rip blades.
7. Explain how to lay out a rip cut on dimensioned lumber.
8. Describe the procedure for ripping dimensioned lumber with a circular saw or table saw.
9. Identify the parts of a table saw and radial saw.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.3 Joint, plane, and sand stock.

**TASK(S):**

3.3.1 Joint stock
3.3.2 Plane stock
3.3.3 Sand stock

**TASK:**

3.3.1 Joint stock.

**PERFORMANCE STANDARD:**

The stock must be shaped to specifications (+ or -) 1/16" with specified angles for all edges. The surface of the stock must be smooth and free of nicks or splinters.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, joiner, plans and specifications, stock.

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Set fence for specified angle.
3. Set depth of cut on infeed table.
4. Examine stock to determine grain pattern.
5. Set stock on infeed table and against fence.
6. Turn on joiner and feed work into cutter head slowly and evenly - avoid placing hands directly over cutter head.
7. Finish cut with pressure applied to outfeed table and fence.
8. May be necessary to take several passes.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Explain how to adjust the outfeed table, adjust the cutting depth, and set the fence at a 90 degree angle.
3. Describe the position of the operator when jointing stock with a push block.
4. Identify the parts of a joiner.
5. Explain how to set joiner knives.
6. Identify chatter marks and their cause.
7. Identify the sizes of joiners.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.3 Joint, plane, and sand stock.

**TASK:**

3.3.2 Plane stock.

**PERFORMANCE STANDARD:**

The stock must be planed to specifications (+ or -) 1/32" with the grain, and must be free of chips, gouges, and cuts.

**TOOLS, RESOURCES, EQUIPMENT, SITUATION(S):**

Standard tool kit, hand plane, plans and specifications, stock, thickness planer

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Select stock and determine amount to be removed.

HAND PLANE

a. Mark desired thickness on stock.
b. Select handplane and check cutter blade.
c. Secure workpiece in holding devices.
d. Apply even pressure on plane as it is pushed over workpiece with grain pattern.
e. Take light cuts - adjust depth wheel as required.
f. Continue cutting action with plane until desired thickness and finish in obtained.

THICKNESS PLANER

a. Determine amount to be removed.
b. Set thickness planer for thickness of material minus 1/16 of an inch.
c. Inspect grain pattern of stock and feed on input table so the grain pattern matches cutter head turning pattern.
d. Catch wood as it exits planer.
e. Repeat steps b. through d. until desired thickness is obtained.

ENABLING OBJECTIVES:

1. Explain the relevant safety practices and procedures.
2. Identify the parts and adjustments made on a portable or stationary power planer.
3. Describe the procedure for operating a portable or stationary power planer.
4. Explain how to sharpen hand plane blades.
5. Identify the types and styles of handplanes and their applications.
6. Explain how to set planer knives.

UNIT: 3 CUTTING, SHAPING, AND FASTENING

LEARNING OUTCOME:

3.3 Joint, plane, and sand stock.

TASK:

3.3.3 Sand stock

PERFORMANCE STANDARD:

The stock must be sanded with the grain and with correct grades of sandpaper. The stock must be free of pencil marks, scratches, and burn marks.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, abrasive, backing block, plans and specifications, power sander, stock

**PERFORMANCE STEPS:**

1. Check plans and specifications for desired finish.
2. Select and secure stock in holding device.
3. Select sanding grit of abrasive.
4. Inspect and determine grain pattern.
5. Back abrasive with block or on power sander.
6. Move abrasive over surface with light pressure (movement must be with grain).
7. Repeat steps 5 and 6 with finer grit papers until pencil marks and scratches are removed.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Explain how to secure work for sanding.
3. Explain the importance of sanding with the grain.
4. Identify the abrasive grit numbering system.
5. Describe the effects of sanding across grain.
6. Differentiate between belt sanders and vibrating sanders.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.4 Cut a dado and gain.

**TASK:**

3.4.1 Cut a dado and gain.

**PERFORMANCE STANDARD:**

The stock must be cut to specifications (+ or -) 1/16" and must be free of burn marks, chips, and splinters.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, plans and specifications, router, stock

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Lay out stock according to plans.

3. Hand technique:
    a. Indent layout lines with chisel.
    b. Cut to depth with saw, if possible.
    c. Use chisel to remove excess material.
    d. Smooth bottom with chisel.
4. Router technique:
    a. Select cutter for desired cut.
    b. Mount cutter in router.
    c. Mount and position jig/holder, if possible.
    d. Turn on router and follow jig or free hand.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify router bits used in cutting a dado.
3. Identify applications for dadoes.
4. Identify router bits and templates used for cutting gains.
5. Explain how to sharpen and hone chisel.
6. Define the terms "dado" and "gain."
7. Identify where dado cuts and gains are used in carpentry.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.5 Bore holes.

**TASK:**

3.5.1 Bore holes.

**PERFORMANCE STANDARD:**

The holes must be 90 degrees to the surface of the stock and located with 1/32" of specifications. Diameter and depth must correspond to the sketch or specifications, and each hole must be free of splinters on the back of the stock.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, drill and bits, plans and specifications, stock/material

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Mark location of hole center on stock.
3. Select drill bit and mount in drill.
4. Back up back side of material to be drilled.

5. Drill hole with even pressure (allow drill to do cutting-do not force).
6. Remove drill from hole.
7. Clean burrs/splinters from back of hole.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify drill and boring bits by size and purpose.
3. Describe how to use a bit and brace.
4. Identify the parts of an electric hand drill.
5. Identify the parts of a drill bit.
6. Differentiate between bits for drilling wood and drilling metal.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.6 Fasten stock with nails and screws.

**TASK(S):**

3.6.1 Fasten stock with nails.
3.6.2 Fasten stock with screws.

**TASK:**

3.6.1 Fasten stock with nails.

**PERFORMANCE STANDARD:**

The nails must be countersunk with no hammer marks on the stock, and the stock must fit securely.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, nails, plans and specifications, stock

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Select nail specified.
3. Locate nailing point on stock.
4. Brace material as necessary.
5. Position and start nail into stock.
6. Check angle flush with surface.
7. Drive nail flush with surface.
8. Set nail with nail set, if required.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the following kinds of nails:
   a. common
   b. box
   c. finishing
   d. brads
   e. tacks
   f. masonry
   g. T-nails.
3. Demonstrate the use of a claw hammer.
4. Demonstrate the use of a power nailer.
5. Explain why nails should be staggered on a grain pattern.
6. Differentiate between soft and hard wood.
7. Identify when it may be necessary to drill pilot holes for nailing.
8. Identify techniques for lubricating nails during installation.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.6 Fasten stock with nails and screws.

**TASK:**

3.6.2 Fasten stock with screws.

**PERFORMANCE STANDARD:**

The screws must be installed in specified locations (+ or -) 1/16" and countersunk without splitting the wood. The stock must fit securely with no visual openings or gaps between the stock.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, drill with bits, plans and specifications, screws, stock

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Lay out/locate position of screw.
3. Select drill bit the size of screw shank.
4. Drill shank hole into stock that accepts head of screw.
5. Countersink shank hole to accommodate screw head.
6. Select drill bit smaller than thread area for pilot drill.

7. Drill pilot hole into second piece of stock.
8. Align parts and insert screw.
9. Tighten screw with driver until screw is tight and flush with surface.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices.
2. Explain why pre-drilling is often done when fastening stock with screws.
3. Identify screws by type and length.
4. Identify types and sizes of drill bits.
5. Differentiate between soft and hard woods.
6. Describe techniques for lubricating the threads while installing a screw.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.7 Construct a square frame.

**TASK:**

3.7.1 Construct a square frame.

**PERFORMANCE STANDARD:**

The frame must be square and constructed to specifications (+ or -) 1/16".

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, layout tools, material, miter box, plans and specifications

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Select material.
3. Mark and miter one end of material.
4. Measure length specified and mark miter.
5. Miter cut end.
6. Repeat steps 3, 4, and 5 until all pieces are cut.
7. Align pieces and tack.
8. Check square.
9. Set nail or screws.
10. Verify measurements.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Explain how to lay out a square frame from a working drawing.
3. Demonstrate the use of a miter box or portable miter saw.
4. Describe how to use framing square.
5. Describe how to use 3, 4, 5 combination for checking square.
6. Differentiate between a butt corner and a mitered corner.

**UNIT: 3 CUTTING, SHAPING, AND FASTENING**

**LEARNING OUTCOME:**

3.8 Cut holes and patterns in stock.

**TASK:**

3.8.1 Cut holes and patterns in stock.

**PERFORMANCE STANDARD:**

All cuts must be free of splinters and must be perpendicular to the surface of the stock (+ or -) 2 degrees. Curves, bends, and turns must be smooth and regular, and the finish cuts must be within specifications (+ or -) 1/16".

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, abrasives, drill and bits, keyhole saw, material, plans and specifications, sawsall

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Select specified material.
3. Lay out shape on material from specifications.
4. Determine tools and procedure required.
5. Secure workpiece.
6. Cut desired shape.
7. Use files or abrasives to remove splinters and obtain desired finish.
8. Verify fit of part.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Describe how to operate a drill.
3. Identify the types and sizes of drill bits.
4. Explain how to set up and operate sawsall.

5. Identify the types of saws available and their applications.
6. Describe how to use framing square.
7. Identify layout tools and their applications.
8. Demonstrate how to use various saws.
9. Explain how to transfer measurements from a working drawing to wood stock.

**UNIT: 4 PREPARING BUILDING SITE**

* Although it is important for carpentry students to understand the concepts including in this unit, it is recommended that the tasks included here be performed by a registered surveyor.

**LEARNING OUTCOME:**

4.1 Locate property lines and elevation reference points.

**TASK:**

4.1.1 Locate property lines and elevation reference points.

**PERFORMANCE STANDARD:**

The boundary or property lines must be set to an accuracy of (+ or -) 1/4". The elevations must be established from the bench mark (+ or -) 1/32" (+ or - .01'). All stakes must be secured in the ground and visible from all points on the plot. Setback distance must meet local code and zoning requirements.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Bench marker, plot plans, registered survey point, transit, triangulation tables

**PERFORMANCE STEPS:**

**CAUTION: RECOMMENDED TO BE DONE ONLY BY REGISTERED SURVEYOR.**

1. Locate registered survey point.
2. Set transit over and plumb to registered pin.
3. Level and calibrate north/south orientation.
4. Set transit for degree, minutes, and seconds specified on plot plan and verify to second point.
5. Set transit for degree, minute, and second specified on plot plan to locate property corner marker.
   NOTE: This may require several moves, depending on location of registered pin or marker. Remember all distances must be corrected to level.
6. Set and align transit on property corner marker.

7. Site transit back to previous mark to calibrate for degree, minutes, and seconds.
8. Turn transit head to specified degree, minutes, and seconds on plot plan for next point.
9. Measure and locate second property stake (corner).
10. Repeat step 8 to locate third property stake (corner).
11. Move transit and align on second or third property stake.
12. Site and measure fourth stake (corner).
13. Move transit and align on fourth stake.
14. Site back and verify length and location corner set in step 9 or 10.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify information given on a plot plan.
3. Explain how to establish or locate property lines.
4. Describe the procedure for locating reference points with the level or transit.
5. Explain how to check the accuracy of measurements and angles.
6. Explain how to set up a level or transit.
7. Identify the components of a builder's level or transit.
8. Reference local code and zoning requirements for residential structures.
9. Explain the necessary safety precautions.

**UNIT: 4 PREPARING BUILDING SITE**

**LEARNING OUTCOME:**

4.2 Lay out a building site.

**TASK:**

4.2.1 Lay out a building site.

**PERFORMANCE STANDARD:**

Stakes must be located within 1/4" of the foundation plans, and building lines must be located according to specifications (+ or -) 1/8". All stakes must be secured in the ground and visible from any point on the building site.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, registered survey markers

**PERFORMANCE STEPS:**

**CAUTION: RECOMMEND THIS BE DONE ONLY BY REGISTERED SURVEYOR.**

1. Check plans and specifications.
2. String taught lines between corners of property markers.
3. Measure and set stakes at set back points.
4. Locate foundation corners from plans and property lines (set battens).
5. Position and mark grade stakes.
6. Verify grading will not interfere with buried utility lines, or other legal requirements.
7. Set story pole and mark elevations.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Explain how to set up and adjust a builder's level or transit.
3. Explain how to establish building corners.
4. Explain how to set hub stakes.
5. Explain the necessary safety precautions.
6. Reference local building codes and zoning regulations regarding limitations.
7. Explain legal ramifications of miscalculating building site layout.
8. Identify the desirability of using a registered surveyor.

**UNIT: 4 PREPARING BUILDING SITE**

**LEARNING OUTCOME:**

**4.3 Install batten boards**

**TASK:**

**4.3.1 Install batten boards**

**PERFORMANCE STANDARD:**

**Batten boards must locate building corners.**

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

**Standard tool kit, nails, plans and specifications, sledge hammer, stock for batten boards and stakes**

**PERFORMANCE STEPS:**

1. Cut stakes.
2. Cut cross member(s).

3. Set stakes at first corner, 6 to 10 feet outside building lines.
4. Set stakes at second corner at an equal distance from building line as for first corner.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Explain the local building codes and zoning regulations requirements for minimum set back and side yard clearance.
3. Explain the purpose of batter boards.
4. Describe how to nail, brace and level batter boards.
5. Describe how to set up and operate a transit.
6. Describe how to use 3, 4, 5 combination to check square of corners.
7. Identify the use of a plumb bob.
8. Explain how to use a line level.

**UNIT: 4 PREPARING BUILDING SITE**

**LEARNING OUTCOME:**

4.4 Locate and square building corners.

**TASK:**

4.4.1 Locate and square building corners.

**PERFORMANCE STANDARD:**

Corners must be located to correspond with specifications on site plan; and diagonal measurements must be equal.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, nails, 100 foot tape measure, plans and specifications, sledge hammer, straight stock

**PERFORMANCE STEPS:**

1. Establish location of proposed construction from plans.
2. Cut stake(s).
3. Locate main reference point on building site to correspond with plans and specifications.
4. Set corner stake at feference point (1) with finishing nail in top as corner point.
5. Determine alignment and distance to next corner and st stake at point 2.
6. Establish line perpendicular to building line.
7. Measure specified distance between corners.

8. Check distance and diagonals against site plan and adjust if necessary.

**ENABLING OBJECTIVES:**

1. Explain how to set up a transit over a hub stake.
2. Explain why the transit must be level and plumbed over the hub before the corner can be squared.
3. Describe the procedure for squaring a corner with a transit.
4. Describe the procedure for squaring a corner by triangulation, parallel, and diagonal methods.
5. Explain the necessary safety precautions.

**UNIT: 4 PREPARING BUILDING SITE**

**LEARNING OUTCOME:**

4.5 Locate and mark excavation lines.

**TASK:**

4.5.1 Locate and mark excavation lines.

**PERFORMANCE STANDARD:**

A clearance of 2'0" must be maintained for form work beyond the building lines. Lines must be visible and parallel to the existing building lines.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, plans and specifications, stakes

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Set and align batten boards.
3. Mark on batten boards excavation depths.
4. Set and position grading stakes.
5. Reference calculated excavation depths to datum markers sewer depth, curb elevation and "official grade strikers").

**ENABLING OBJECTIVES:**

1. Explain why there are different requirements for block and poured concrete foundation walls.
2. Explain the reason why building lines are removed for excavation.
3. Describe how to set up and operate a transit.
4. Reference local building codes and zoning regulations for excavation requirements and limitations.

5. Describe soil conditions that effect excavation.
6. Identify techniques for bracing or shoring excavations.
7. Explain the relevant safety practices and procedures for marking excavation.
8. Explain safety factors when excavating.

**UNIT: 4 PREPARING BUILDING SITE**

**LEARNING OUTCOME:**

4.6 Set grade stakes.

**TASK:**

4.6.1 Set grade stakes.

**PERFORMANCE STANDARD:**

Grade stake must be marked with distance noted up or down to specified elevation.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, builder's level, plans and specifications, sledge hammer, stock

**PERFORMANCE STEPS:**

1. Cut stakes.
2. Determine location of grade stake(s) from plans and specifications.
3. Set grade stake at highest corner.
4. Set and level builder's level.
5. Calculate desired elevation at grade stake.
6. Take reading of bench mark.
7. Take reading of grade at grade stake and mark pencil line at base of stake.
8. Mark distance up or down on grade stake at desired elevation.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify local building code restrictions relevant for grading.
3. Describe how to calculate slope angles.
4. Explain the purpose of grade stakes.
5. Identify the function of bench marks.
6. Describe how to set up and operate transit.

**UNIT: 5 PREPARING CONCRETE FORMS**

**LEARNING OUTCOME:**

5.1 Construct slab forms.

**TASK:**

5.1.1 Construct slab forms.

**PERFORMANCE STANDARD:**

All forms must be plumb and straight and assembled to specifications (+ or -) 1/8". The stakes must be secure with ties and bracing securely attached to prevent movement of the forms when concrete is poured.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, builders level, circular saw, framing lumber, mattock/pick, nails, plans and specifications, shovel, sledge hammer

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Locate form corner.
3. Pull and tighten grade lines.
4. Select and assemble form sides - slab together on exterior side to obtain lumber desired length.
5. Position forms.
6. Locate and position anchor stakes.
7. Secure stakes.
8. Add braces and secure braces to the stakes.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Reference FHA and local building codes regarding slab foundations.
3. Identify the applications for slab foundations.
4. Identify the materials used in constructing slab forms.
5. Explain how to use 3,4,5 combination to check form for being square.
6. Identify various concrete mixes.
7. Describe frost line considerations.
8. Describe the weight the forms must withstand while pouring and curing.
9. Identify moisture shields.
10. Explain how to position reinforcing rods and mesh.

**UNIT: 5 PREPARING CONCRETE FORMS**

**LEARNING OUTCOME:**

5.2 Align and brace foundation forms.

**TASK:**

5.2.1 Align and brace foundation forms.

**PERFORMANCE STANDARD:**

Form must be of specified thickness and width; top edge must be level with grade stake; and form must be structurally able to hold concrete.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, builder's level, circular saw, mattock, nails, pick, plans and specifications, shovel, sledge hammer

**PERFORMANCE STEPS:**

1. Determine size of footing from plans.
2. Set stock along perimeter of proposed footing and cut to length.
3. Set stakes on established footing line to specified elevation.
4. Nail side panels to stakes at specified elevation.
5. Check form for level and elevation and adjust as necessary.
6. Set stock for opposite side of footing form and cut to length.
7. Set second set of stakes on opposite footing line.
8. Nail side panels to stakes at specified elevation.
9. Check level and elevation and adjust as necessary.
10. Cut furring for spreaders to width of form.
11. Align and secure.
12. Shovel dirt around outside of form.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Reference FHA and local building codes regarding footers.
3. Identify square-type and T-type footing forms.
4. Explain the use of a spreader to check form width.
5. Identify materials used for bracing foundation walls.
6. Define honeycombing.
7. Explain how to use 3,4,5 combination to check squareness of corners.

**UNIT: 5 PREPARING CONCRETE FORMS**

**LEARNING OUTCOME:**

5.3 Install anchor bolt.

**TASK:**

5.3.1 Install anchor bolts.

**PERFORMANCE STANDARD:**

Anchor bolt must be secure in concrete and set according to plans with specified exposure.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, anchor bolts, drill and bits, plans and specifications, stock

**PERFORMANCE STEPS:**

1. Check plans and specification for type and location of anchor bolts.
2. Determine specification of the anchor bolt.
3. Locate placement point for the anchor bolt.
4. Bore holes at placement points; diameter of the hole should be 1/16" larger than the diameter of the anchor bolt being used.
5. Position anchor bolt templet.
6. Insert anchor bolt.
7. Place washer over bolt, thread the nut in place.
8. Insure anchor bolt will not be displaced when the concrete is being poured.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Reference FHA specification and local building codes regarding anchor bolts.
3. Identify the function of an anchor bolts.
4. Identify the styles and sizes of anchor bolts.
5. Describe material often bent and substituted for anchor bolts.
6. Describe procedure for installing anchor bolts in concrete block walls.

**UNIT: 5 PREPARING CONCRETE FORMS**

**LEARNING OUTCOME:**

5.4 Build concrete step and stair forms.

**TASK:**

5.4.1 Build concrete step and stair forms.

**PERFORMANCE STANDARD:**

Stair form must be secure, plumb and aligned as specified in plans; and stair form must be structurally able to hold concrete.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, nails, plans and specifications, plywood, sheathing, sledge hammer, straight stock

**PERFORMANCE STEPS:**

1. Check plans and specifications for stair detail.
2. Calculate rise and run of form.
3. Calculate number of risers, unit rise, and unit run.
4. Select stock.
5. Lay out and cut stair stringers.
6. Secure stringer in position with supports.
7. Install sheathing or plywood on underside of stringer as necessary.
8. Secure form with supports and braces.
9. Measure and cut risers to width and length.
10. Bevel bottom edge of risers.
11. Install risers.
12. Brace risers as necessary.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify tread-riser ratio.
3. Identify sizes of dimensional lumber.
4. Explain how to calculate volume of concrete for stairs.
5. Describe the weight the forms must withstand while pouring and curing.
6. Identify various concrete mixes.
7. Describe materials for fill voids in forms.

**UNIT: 6 FRAMING FLOORS**

**LEARNING OUTCOME:**

6.1 Lay out a floor frame.

**TASK:**

6.1.1 Lay out a floor frame.

**PERFORMANCE STANDARD:**

All materials must be marked accurately for cutting and installing the floor frame according to specifications (+ or -) 1/16". Materials must be marked to indicate maximum use of wood stock and dimensioned lumber.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, dimensional lumber, plans and specifications

**PERFORMANCE STEPS:**

1. Check plans and specifications for size of materials and lay out of openings.
2. Select, cut and mark crown of floor joists.
3. Select and cut sill plates.
4. Select and cut sill headers.
5. Select, cut and mark crown of opening headers.
6. Determine number and location of joist hangers.
7. Assemble material in orderly fashion to facilitate assembling ease.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Reference FHA and local building code regarding floor frames.
3. Identify the following floor framing terms:
   a. sill plate
   b. anchor bolt
   c. sill sealer or vapor barrier
   d. built-up girder
   e. column
   f. bearing plate
   g. joist header
   h. floor joist
   i. toenail
   j. crown
   k. cross bridging
   l. subfloor
   m. platform framing
   n. O.C.
4. Identify floor frame members from working drawings.
5. Identify tools and materials needed to lay out a floor frame.
6. Describe sizes of dimensional lumber.
7. Explain how to calculate load ratings.
8. Identify spanning capabilities of dimensional lumber.

**LEARNING OUTCOME:**

6.2 Cut and install sill plates.

**TASK:**

6.2.1 Cut and install sill plates.

**PERFORMANCE STANDARD:**

Sill plate must be level; sill members must be protected against moisture; plate and wall seam must be airtight; corners must be square and diagonals must be equal from corner to corner; and size and spacing of anchor bolts must conform to specifications.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, building foundation, flat washers and nuts, moisture seal, plans and specifications, straight stock.

**PERFORMANCE STEPS:**

1. Check plans and specifications for size and setback of sill plate.
2. Mark setback with chalk line.
3. Measure and cut first length of plate, using single piece if possible.
4. Cut any additional plate lengths with all ends square.
5. Place plate(s) upright along chalk line and mark position of anchor bolts.
6. Drill holes for each bolt.
7. Set plate(s) over anchor bolts.
8. Check for fit and adjust if necessary.
9. Remove plate(s) and install moisture seal.
10. Replace and secure plate in place with washers and nuts.
11. Continue to set plate over anchor bolts for remaining perimeter of foundation.
12. Return to starting point to install second layer of plates for built-up sill, staggering joints.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Reference FHA specifications and local building codes regarding sill plates.
3. Explain the purpose of a sill plate.
4. Identify the size and type of lumber used for sills.
5. Explain how to drill holes for anchor bolts.
6. Demonstrate the 6-8-10 method for squaring the sill at a corner.
7. Identify moisture sealant available and their applications.
8. Describe a termite shield and how it is installed.

**UNIT: 6 FRAMING FLOORS**

**LEARNING OUTCOME:**

6.3 Frame and install a built-up sill and box sill.

**TASK(S):**

6.3.1 Frame and install a built-up sill.
6.3.2 Frame and install a box sill.

**TASK:**

6.3.1 Frame and install a built-up sill.

**PERFORMANCE STANDARD:**

Built-up sill must overlap joints of sill plate, be flush without edge, weather tight and corners must be squared.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, adhesive, circular saw, dimensional lumber, nails/spikes, plans and specifications, sill plates installed

**PERFORMANCE STEPS:**

1. Check plans and specifications for size.
2. Measure and cut first length of plate - must lap joints of previous sill plate.
3. Place plate upright along sill plate and mark anchor bolts.
4. Drill out anchor bolt holes.
5. Check fit and adjust.
6. Remove plate and apply adhesive.
7. Replace plate and spike in place.
8. Continue to set plate, overlapping joints for remaining perimeter of foundation.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Describe the function of a built-up sill.
3. Identify fastening requirement and materials used to frame a built-up sill.
4. Differentiate between a built-up sill and a box sill.
5. Reference FHA specifications and local building codes regarding built-up sills.
6. Identify building adhesives.

**UNIT: 6 FRAMING FLOORS**

**LEARNING OUTCOME:**

6.3 Frame and install a built-up sill and box sill.

**TASK:**

6.3.2 Frame and install a box sill.

**PERFORMANCE STANDARD:**

The sill header must be flush with the outside edge of the plate, cut to specified length (+ or -) 1/16", and square at the ends.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, adhesive, circular saw, dimensional lumber, nails/spikes, plans and specifications, sill plates installed

**PERFORMANCE STEPS:**

1. Check plans and specifications for size of floor joists.
2. Select dimensional lumber the same width as floor joist.
3. Start in corner, overlapping sill plate joints.
4. Start in corner and apply bead of adhesive to outside surface of sill plate.
5. Stand header (box sill plate) on edge flush with outside edge of sill plate.
6. Spike/nail header to sill plate.
7. Continue installing header on perimeter of foundation sill plate.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the fastening pattern for installing a box sill.
3. Identify the size and type of lumber used for a box sill.
4. Describe the function of a box sill.
5. Reference FHA and local building codes regarding box sills.
6. Identify nails by size and type.
7. Describe building adhesives available.

**UNIT: 6 FRAMING FLOORS**

**LEARNING OUTCOME:**

6.4 Install posts and columns.

**TASK:**

6.4.1 Install posts and columns.

**PERFORMANCE STANDARD:**

Planks for floor framing must be long enough to bridge a minimum of two spans between beams; two metal straps must be used to connect spliced beams at each post; beams must be connected with metal gusset plates and secured to posts with framing anchors in roof framing; framing must be square and plumb and must meet plans and specifications.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, beam hangers, beams, chain saw, circular saw, framing anchors, gusset plates, metal strapping, nails, plans and specifications, posts, roof planking, spikes, straight stock

**PERFORMANCE STEPS:**

1. Check plans for post and beam placement.
2. Lay out and mark post placement on sill plates.
3. Determine number and specifications for posts and beams.
4. Select posts and beams.
5. Measure and cut stock for post.
6. Cut or construct beams as required.
7. Install posts and beams for:

<u>Floor framing</u>

a. Install fasteners for posts as per plans and specifications.
b. Drill posts to receive fasteners.
c. Center posts.
d. Attach posts loosely.
e. Check for plumb.
f. Secure posts permanently.
g. Add bearing blocks to posts.
h. Splice beams.
i. Connect spliced beams with metal straps.

<u>Wall framing</u>

a. Measure and cut blocks for side wall center posts.
b. Toenail center posts to edge joists and blocking.
c. Measure and cut studs.
d. Measure and cut top and bottom plates.
e. Mark plates for stud locations.
f. Assemble wall components.
g. Lift wall section into place.
h. Nail wall section through bottom plate.

i. Straighten and brace wall.
j. Assemble, nail, and brace remaining wall sections.
k. Install diagonal bracing.
l. Secure top plates with steel strapping.
m. Install blocking.

Roof framing

a. Check plans for post spacing for ridgeboard.
b. Install interior posts.
c. Cut ridgeboard members to length.
d. Position first section of ridgeboard on posts.
e. Fasten beam to post with framing anchors.
f. Position remaining sections of ridgeboard and fasten.
g. Connect ridgeboard members with gusset plates.
h. Check plans for treatment of ridge and plate.
i. Determine length of rafter beams for plans.
j. Cut and notch all upper ends of rafter beams.
k. Cut and notch lower ends of rafter beams.
l. Mark beam locations on ridgebeam.
m. Position center rafter over wall post.
n. Toenail center rafter in place.
o. Fit rafter beam in position.
p. Toenail rafter beam in place.
q. Secure rafter with beam hangers.
r. Attach rafter beam to plate with framing anchor.
s. Toenail and secure remaining rafter beams until all pairs of rafter beams are in place, working from center out.
t. Nail metal strapping across tops of pairs of beams.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify types of posts and columns by size, type of material, and required fasteners.
3. Describe the function of a post or column.
4. Explain how to calculate floor load, wall loads and roof loads.
5. Reference FHA specifications and local building codes regarding post and columns.
6. Define the term bearing member.

**UNIT: 6 FRAMING FLOORS**

**LEARNING OUTCOME:**

6.5 Frame and install a built-up girder and floor opening.

**TASK(S):**

6.5.1 Frame and install a built-up girder.
6.5.2 Frame floor openings.

**TASK:**

6.5.1 Frame and install a built-up girder.

**PERFORMANCE STANDARD:**

The lumber selected for framing must be free of defects. Joints must be staggered and fastened to specifications (+ or -) 1/16", and overall length and position of the girder must be within specifications (+ or -) 1/16".

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, dimensional lumber, plans and specifications

**PERFORMANCE STEPS:**

1. Consult plans and specifications for size of built-up girder.
2. Determine support points.
3. Select dimensional lumber (if lumber is not sufficient length, joints must be staggered and located at support points).
4. Cut lumber to desired length.
5. Mark crown side of lumber.
6. Apply adhesive to face of first piece.
7. Position second piece on face of first piece with crown facing same direction and nail.
8. Continue to add lumber pieces with adhesive and nails until girder is desired length and thickness.
9. Raise built-up girder into place on supports and secure as specified.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify fastening requirements for a built-up girder.
3. Identify building materials used to frame a built-up girder.
4. Describe the advantages and disadvantages of a built-up girder.
5. Identify the spanning capabilities of dimensioned lumber.
6. Reference FHA and local building codes regarding built-up girders.
7. Compare solid girder and built-up girder load carrying abilities.
8. Explain how to calculate floor loads and girder or beam loads.

**LEARNING OUTCOME:**

6.5 Frame and install a built-up girder and floor openings.

**TASK:**

6.5.2 Frame floor openings.

**PERFORMANCE STANDARD:**

Floor framing members around large openings must be doubled; dimensions and location of floor opening must be as specified on plans.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, joist hangers, nails, plans and specifications, straight stock

**PERFORMANCE STEPS:**

1. Determine location and dimensions of floor opening from plans.
2. Select stock for joists and headers.
3. Measure and cut floor joists.
4. Measure and cut trimmer joists.
5. Measure and cut headers.
6. Mark rough opening position on joists.
7. Install floor joists.
8. Install trimmer joists.
9. Install double headers.
10. Measure, cut, and install tail joists.
11. Install joist hangers on all non-supported joist and header ends.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify floor openings from working drawings.
3. Identify fastening requirements for floor openings.
4. Identify materials used for floor openings.
5. Define tail joist, trimmer joist and double header.
6. Reference FHA specifications and local building.
7. Identify hangers for floor joists.

**UNIT: 6 FRAMING FLOORS**

**LEARNING OUTCOME:**

6.6 Cut and install floor joists and adjust bridging.

**TASK(S):**

6.6.1 Cut and install floor joists.
6.6.2 Cut, install and adjust joist bridging.

**TASK:**

6.6.1 Cut and install floor joists.

**PERFORMANCE STANDARD:**

All joists must be level, plumb with crowns up, and must be parallel and spaced as specified on plans.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, nails, plans and specifications, straight stock

**PERFORMANCE STEPS:**

1. Determine direction and specifications of floor joists.
2. Lay out header joists on sill plate in platform construction.
3. Attach headers to sill.
4. Measure and cut end bands in sill installation.
5. Nail end bands in position.
6. Determine location of floor openings from plans.
7. Lay out and mark floor joists positions on header joists or sill plates.
8. Measure and cut floor joists.
9. Nail joists in place.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify fastening requirements for floor joists.
3. Identify dimensioned lumber used for floor joists.
4. Explain how to determine the crown.
5. Describe how to calculate floor load.
6. Identify dimensioned lumber spanning capabilities.
7. Reference FHA specifications and local building codes regarding floor joists.
8. Identify the terms: header, and sill plates.

**UNIT: 6 FRAMING FLOORS**

**LEARNING OUTCOME:**

6.6 Cut and install floor joists and adjust bridging.

**TASK:**

6.6.2 Cut, install and adjust joist bridging.

**PERFORMANCE STANDARD:**

Cross-bridging must be installed in straight line at intervals not to exceed 8 feet. Cross-bridging must be cut to specified angle (+ or -) 2 degrees.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, nails, plans and specifications, straight stock

**PERFORMANCE STEPS:**

1. Locate position of bridging from plans.
2. Measure length from top of joist to bottom of adjacent joist.
3. Calculate angle of cut.
4. Cut two pieces of bridging for each joist space.
5. Strike chalk line across tops of joists.
6. Secure each bridging to top of each joist with two nails.
7. Secure bottoms of bridging after installation of subfloor.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the following types of bridging or blocking:
   a. cross
   b. solid
   c. staggered
3. Identify fastening requirements for joist bridging.
4. Identify materials used for joist bridging.
5. Explain why the subfloor is installed before bridging is fastened permanently.
6. Reference FHA specifications and local building codes regarding joist bridging.

**UNIT: 6 FRAMING FLOORS**

**LEARNING OUTCOME:**

6.7 Install a subfloor.

**TASK:**

6.7.1 Install a subfloor.

**PERFORMANCE STANDARD:**

Subflooring must be tight, free of squeaks with nail heads flush; plyscore subflooring joints must be staggered.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, glue gun, nails, plans and specifications, plyscore

**PERFORMANCE STEPS:**

1. Check plans for subfloor specifications.
2. Measure deck for square.
3. Strike line on joist according to width of plyscore.
4. Run glue bead on joist.
5. Align first full sheet.
6. Nail sheet.
7. Complete first row.
8. Continue to glue and nail sheets in place until subfloor is completed.
9. Trim ends.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify materials and fastening patterns used for installing subfloors.
3. Identify the functions/purpose of subfloor.
4. Differentiate between plywood and particleboard subfloors.
5. Describe tongue-and-groove subfloor.
6. Explain how to cut subflooring material to minimize waste.
7. Reference FHA specifications and local building codes regarding subflooring.
8. Identify building adhesives and their applications.

**UNIT: 7 FRAMING WALLS**

**LEARNING OUTCOME:**

7.1 Lay out a wall frame.

**TASK:**

7.1.1 Lay out a wall frame.

**PERFORMANCE STANDARD:**

All materials must be marked accurately for cutting and framing the wall frame according to specifications (+ or -) 1/16". Materials must be marked to indicate maximum use of wood stock and dimensioned lumber.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, framing material, plans and specifications

**PERFORMANCE STEPS:**

1. Consult plans for wall specifications.
2. Select and cut top and bottom plates.
3. Lay out and mark position of studs, jacks, and wall openings according to plans.
4. Select, measure, and cut studs to length calculated.
5. Select, measure, and cut header, jacks, cripplers and sills.
6. Stock components in orderly fashion.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the following wall framing terms:
   a. bearing wall
   b. exterior wall frame
   c. partition
   d. sole plate
   e. double top plate
   f. stud
   g. rough wall opening
   h. trimmer stud
   i. cripple stud
   j. header
   k. corner post
   l. let-in or diagonal bracing
   m. exterior sheathing
   n. rough window sill
   o. O.C.
3. Identify wall framing members from working drawings.
4. Identify tools and materials needed to lay out a wall frame.
5. Reference FHA specifications and local building codes regarding wall framing.
6. Identify nails by size and length.
7. Describe the sizes of dimensional lumber.

**UNIT: 7 FRAMING WALLS**

**LEARNING OUTCOME:**

7.2 Construct corner posts and T-posts.

**TASK:**

7.2.1 Construct corner posts and T-posts.

**PERFORMANCE STANDARD:**

The dimensioned lumber must be straight, sound material cut to specified length (+ or -) 1/16". Ends must be flush (+ or -) 1/32" for fastening to plates. Blocking must be positioned according to the drawing specifications (+ or -) 1/16", and members must be fastened in the required pattern.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, dimensioned framing lumber, nails, plans and specifications

**PERFORMANCE STEPS:**

Corner Post:

1. Consult plans and specifications.
2. Select dimensional lumber and cut to length for studs.
3. Select scrap pieces of same dimensional lumber for spacers.
4. Position pieces of dimensional lumber between faces of two studs.
5. Align studs top and bottom.
6. Nail studs to spacer.

T-Posts:

1. Consult plans and specifications.
2. Select dimensional lumber for studs to form.
3. Cut studs to length.
4. Position and nail studs together to form T shape.
5. Install T shaped stud on end of partition wall aligning with exterior wall.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the function of a corner post and T-post.
3. Explain the difference between a corner post and T-post.
4. Reference FHA specifications and local building codes regarding corner posts and T-posts.

5. Identify fastening requirements for corner posts and T-posts.
6. Identify common dimensional lumber for corner posts and T-posts.

**UNIT: 7 FRAMING WALLS**

**LEARNING OUTCOME:**

7.3 Frame and align an exterior wall.

**TASK:**

7.3.1 Frame and align an exterior wall.

**PERFORMANCE STANDARD:**

Studs, plates, sills, and headers must be cut and assembled to specifications (+ or -) 1/16" using required fastening patterns. The erected wall frame must be plumb (12 degrees), straight (+ or - 1/16"), and secured to the floor frame.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, framing lumber, nails, plans and specifications

**PERFORMANCE STEPS:**

Frame Exterior Wall

1. Check plans for wall specifications.
2. Select stock for plates.
3. Measure and cut top and bottom plates.
4. Lay out and mark position of studs, jacks, and wall openings according to plans.
5. Measure and cut studs.
6. Set studs and plates on edge next to layout marks.
7. Nail each stud in place between plates.
8. Lay out and cut cripples, headers, jacks, and sills.
9. Install headers, cripples, jacks, and sills.
10. Strike chalk line for positioning.
11. Square wall using diagonal measurement method.
12. Apply sheathing if specified on plans.
13. Tilt wall upright into place.
14. Nail through bottom plate into floor framework.
15. Brace for plumb.

Align and Brace Exterior Wall

1. Select stock for temporary braces.
2. Locate position of wall from plans and chalk line.

3. Tilt wall along line and nail in place.
4. Position brace at wall ends for corner brace.
5. Drive nail three quarters of the way to hold each brace.
6. Nail temporary block in line with each brace at point where brace touches floor.
7. Plumb wall.
8. Nail each brace to temporary block to hold wall in place.
9. Check for plumb perpendicular to wall.
10. String dryline between corners.
11. Align wall with spacer blocks and brace.
12. Nail diagonal brace parallel on wall to plumb.
13. Plumb parallel to wall.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify components of an exterior wall frame.
3. Identify tools and materials needed to frame and align an an exterior wall.
4. Explain how wall frame openings for doors and windows are constructed.
5. Explain how to square wall with diagonal measurement techniques.
6. Reference FHA specifications and local building codes regarding exterior wall frames.

**UNIT: 7 FRAMING WALLS**

**LEARNING OUTCOME:**

7.4 Frame, align and anchor a partition wall.

**TASK:**

7.4.1 Frame, align and anchor a partition wall.

**PERFORMANCE STANDARD:**

Studs, plates, and headers must be cut and assembled to specifications (+ or -) 1/16" using required fastening patterns. The erected partition must be plumb (+ or - 2 degrees), straight (+ or - 1/16"), and secured to the floor frame and exterior wall.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, framing material, plans and specifications

**PERFORMANCE STEPS:**

1. Check plans for wall specifications.
2. Select stock for plates and studs.
3. Measure and cut top and bottom plates.
4. Lay out and mark position of studs and openings according to plans.
5. Measure and cut studs.
6. Set studs and plates on edge next to layout marks.
7. Nail each stud in place between plates.
8. Lay out and cut cripples, headers and sills.
9. Install crippler, headers and sills.
10. Strike line on floor for position of partition.
11. Square wall using diagonal measurement method.
12. Tilt wall upright into place.
13. Nail through bottom plate into floor framework.
14. Plumb wall with level.
15. Anchor partition to exterior wall or adjacent wall.
16. Align partition with string technique and secure to ceiling joists.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the components of a partition wall frame.
3. Identify dimensional lumber for partitions.
4. Define a load carrying partition.
5. Reference FHA specifications and local building codes regarding partitions and anchoring.

**UNIT: 7 FRAMING WALLS**

**LEARNING OUTCOME:**

7.5 Install metal door and window frames.

**TASK:**

7.5.1 Install metal door and window frames.

**PERFORMANCE STANDARD:**

Frames must be set plumb, level, and in alignment with walls. Clearances must be so that door or windows open and close without binding.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, frame walls with roughed in openings, metal door and window units, nails, plans and specifications

**PERFORMANCE STEPS:**

1. Consult plans for location of units.
2. Lift and position unit into opening from exterior side.
3. Plumb and level unit - (shim as needed).
4. Nail/fasten unit to opening as specified by manufacturer.
5. Check unit for proper operation - adjust if necessary.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Describe how spacers and braces are used to install metal doors and windows.
3. Identify types and styles of window units.
4. Describe the advantages of metal doors.
5. Describe the procedure for roughing in and opening in a wall.
6. Reference FHA and local building codes regarding windows and doors.

**UNIT: 7 FRAMING WALLS**

**LEARNING OUTCOME:**

7.6 Install backing for fixture or cabinets.

**TASK:**

7.6.1 Install backing for fixture or cabinets.

**PERFORMANCE STANDARD:**

Backing must be at height specified on plans and specifications and must provide secure backing for wood screws.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, framed wall, nails, plans and specifications, straight stock

**PERFORMANCE STEPS:**

1. Determine final placement of cabinet or fixture from plans and specifications.
2. Measure height at which screws for holding fixture or cabinets will be placed, allowing for difference between sub-floor and finished floor in measurement.
3. Transfer measurement to studs.
4. Cut and measure blocks to fit between studs.
5. Nail blocks in place at desired height.

ENABLING OBJECTIVES:

1. Explain the relevant safety practices and procedures.
2. Identify nailing strips and materials used for fixture or cabinet backing.
3. Identify the function of backing strips.
4. Describe possible locations for backing strips.
5. Identify load carrying requirements for backing strips.

UNIT: 7 FRAMING WALLS

LEARNING OUTCOME:

7.7 Build a box beam.

TASK:

7.7.1 Build a box beam.

PERFORMANCE STANDARD:

The plywood webs and braces must be cut and assembled to specifications (+ or -) 1/8". Joints must be staggered and fastened according to required patterns. Beam must be flush with interior and exterior surface of wall frame.

TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):

Standard tool kit, circular saw, nails, plans and specifications, plywood straight stock

PERFORMANCE STEPS:

1. Consult plans for beam specifications.
2. Select dimensional lumber capable of supporting load.
3. Measure and cut two pieces specified lumber to length for headers.
4. Cut plywood spacer to length and width.
5. Nail plywood web between headers.
6. Position header in opening of wall frame.
7. Nail into positions so as to be flush with interior and exterior surface of framed wall.

ENABLING OBJECTIVES:

1. Explain the relevant safety practices and procedures.
2. Identify the purpose of a box beam or header.
3. Describe where box beams are used for house construction.
4. Reference FHA specifications and local building codes regarding box beams.

5. Identify the thickness of dimensional lumber and thickness of available plywood.
6. Define the term toenailing.

**UNIT: 7 FRAMING WALLS**

**LEARNING OUTCOME:**

7.8 Install structural sheathing.

**TASK:**

7.8.1 Install structural sheathing.

**PERFORMANCE STANDARD:**

Sheathing must be installed with no protrusions in openings or beyond corners; and sheathing must be nailed according to plans and specifications.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, framed wall, nails, sheathing, plans and specifications

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Determine lay out of sheathing from stud spacing.
3. Measure and cut sheathing to fit from corner edge to stud center.
4. Nail first sheet in place.
5. Measure and cut rough openings as necessary.
6. Nail subsequent sheets butting sides.
7. Measure and cut final sheet to be flush on outside corner.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify types of structural sheathing and fastening requirements for each type.
3. Explain why sheathing is sometimes installed before the wall frame is erected, or after the rough frames for the roof and ceiling are installed.
4. Explain the purpose of using plywood for sheathing on corners.
5. Reference FHA and local building codes regarding exterior sheathing.
6. Define the term plumb.

**UNIT 8: FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.1 Lay out a ceiling frame

**TASK:**

8.1.1 Lay out a ceiling frame

**PERFORMANCE STANDARD:**

All materials must be marked accurately for cutting and framing the ceiling frame according to specifications (+ or -) 1/16". Materials must be marked to indicate maximum use of wood stock and dimensioned lumber.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, framing material, plans and specifications.

**PERFORMANCE STEPS:**

1. Consult plans and specifications.
2. Identify the bearing walls.
3. Determine load requirements and spans.
4. Select joist lumber size based on span and load requirements.
5. Determine and cut to length ceiling joists.
6. Cut and mark any support beams.
7. Select and mark position of any support brackets.

**ENABLING OBJECTIVES:**

1. Identify the following ceiling framing terms: (a) ceiling joist, (b) crown, (c) span, and (d) strongback.
2. Identify ceiling frame members from working drawings.
3. Identify tools and materials needed to lay out a ceiling frame.
4. Explain the relevant safety practices and procedures.
5. Reference FHA and local building codes regarding ceiling frames.
6. Identify common joists sizes and their spanning capabilities.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.2 Cut and install ceiling joists and joist strongbacks.

**TASK(S):**

8.2.1 Cut and install ceiling joists.
8.2.2 Cut and install ceiling joist strongbacks.

**TASK:**

8.2.1 Cut and install ceiling joists.

**PERFORMANCE STANDARD:**

Joists must be parallel and spaced as specified on plans and specifications; and joists must be installed crown side up.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, nails, plans and specifications, straight stock.

**PERFORMANCE STEPS:**

1. Determine length and spacing of joists from plans.
2. Select and measure joist stock.
3. Cut joist to length squaring one end.
4. Calculate and cut angle of joist ends as necessary.
5. Lay out and mark on top plates.
6. Set second joist from corner in position.
7. Toenail through sides of joists nailing outer ends first.
8. Line up each joist on top plate, mark and toenail.
9. Cut and install firestops as required.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify fastening requirements for ceiling joists.
3. Identify dimensioned lumber used for ceiling joists.
4. Explain how to determine the crown.
5. Explain how to cut joist ends for roof rafter intersection, if required.
6. Reference FHA specifications and local building codes for ceiling joists.
7. Describe the function of joist strongbacks.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.2 Cut and install ceiling joists and joist strongbacks.

**TASK:**

8.2.2 Cut and install ceiling joist strongbacks.

**PERFORMANCE STANDARD:**

The strongbacks must be cut to required length (+ or -) 1/16", positioned above and perpendicular to the joists, and fastened to the joists with metal straps or fasteners.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, ceiling joists in place, circular saw, nails, plans and specifications, straight stock.

**PERFORMANCE STEPS:**

1. Consult plans and specifications.
2. Determine length of strongback.
3. Mark strongback for joist alignment.
4. Position strongback on top of joist so as not to interfere with roof rafters.
5. Nail perpendicular to first joist, align marks.
6. Tap adjacent joist to align spacing and nail into position.
7. Repeat step 6 until all joists are aligned and attached to strongback.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the function of a strongback.
3. Identify materials for use as strongbacks.
4. Identify fastening requirements for strongbacks.
5. Reference FHA specifications and local building codes regarding strongbacks.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.3 Frame a ceiling opening.

**TASK:**

8.3.1 Frame a ceiling opening.

**PERFORMANCE STANDARD:**

The openings must be square and within size specifications (+ or -) 1/16". All frame members and tail joists must be cut to required length (+ or -) 1/16" and installed straight and plumb with the required fasteners.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, plans and specifications.

**PERFORMANCE STEPS:**

1. Determine location and size of opening from plans.
2. Determine and cut header.
3. Position header between joists.
4. Construct frame to internal dimensions.
5. Lift frame into opening and secure to joists and headers.
6. Cut and install additional bracing as required for secure fit.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify ceiling openings from working drawings.
3. Identify fastening requirements for ceiling openings.
4. Describe common ceiling openings.
5. Describe function of headers.
6. Identify braces and straps commonly used for ceiling openings.
7. Reference FHA specifications and local building codes regarding ceiling openings.

**UNIT: FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.4 Lay out a roof frame.

**TASK:**

8.4.1 Lay out a roof frame.

**PERFORMANCE STANDARD:**

All materials must be marked accurately for cutting and framing the rafters, ridgeboard, gables, dormers, purlins, and collar beams according to specifications (+ or -) 1/16". Materials must be marked to indicate maximum use of wood stock and dimensioned lumber.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, framing material, framing square, plans and specifications.

**PERFORMANCE STEPS:**

1. Consult plans and specifications.
2. Determine type of roof, spans and roof load.
3. Select rafter lumber sizes based on span, pitch, and load.
4. Determine length of ridge board.
5. Determine types of rafters required.
6. Determine length of rafters and cuts required.
7. Lay out and cut rafters.
8. Identify and cut bracing required.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the following roof framing terms: (a) common framing terms: (a) common rafter, (b) crown, (c) flush (d) alignment, (e) framing square, (f) rafter scale, (g) rise, (h)run, (i) slope, j) plumb cut, (k) plate cut, (l) bird's mouth or seat,(m) ridge or ridgeboard), (n) hip rafter, (o) valley rafter, (p) jack rafter, (q) barge rafter, (r) gable end, (s) framing anchor, (t) pitch, (u) span, and (v) tail.
3. Identify from blueprints or drawings the following roof types: (a) shed, (b) flat, (c) gable, (d) hip, (e) gambrel, and (f) mansard.
4. Identify roof frame members from working drawings.
5. Identify tools and materials needed to lay out a roof frame.
6. Explain how to use a framing square and rafter tables to determine rafter length and angle or cuts.
7. Demonstrate how to lay out rafters with different slopes and lengths.
8. Identify parts of the framing square.
9. Explain why most carpenters prefer the step-off method for determining rafter length and angle of cuts.
10. Solve mathematical problems involving multiplication and division of mixed numbers.
11. Describe the procedure for laying out a roof frame.
12. Reference FHA specifications and the local building code regarding roof frames.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.5 Cut and install common, valley, hip, and jack rafters.

**TASK(S):**

8.5.1 Cut and install common rafters.
8.5.2 Cut and install valley rafter and valley jack rafters.
8.5.3 Cut and install hip rafter and hip jack rafters.

**TASK:**

8.5.1 Cut and install common rafters.

**PERFORMANCE STANDARD:**

Top cuts of common rafters must fit ridgeboard; bird's mouth depth must be as specified and must fit base; tail cut must be plumb; and rafter must be as specified on plans.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, ceiling joists in place, circular saw, nails, plans and specifications, sawhorses, straight stock.

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Measure width of building for span.
3. Divide span in half for run.
4. Calculate length of rafter using run, rise, and framing square.
5. Establish crown of rafter stock.
6. Place one piece of rafter stock on sawhorses.
7. Lay out and mark rafter pattern.
8. Draw bird's mouth.
9. Check plans for size of rafter overhang.
10. Lay out overhang.
11. Mark tail cut.
12. Check cornice details on plans.
13. Shorten rafter for ridgeboard.
14. Cut rafter on marks.
15. Label rafter as pattern rafter.
16. Cut all rafters using pattern.
17. Check fit of rafters at ridge, plate, and tail cut.
18. Cut all rafters.
19. Nail rafters to plates and ridgeboard.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Define equal pitch and unequal pitch.

3. Identify fastening requirements for common rafters.
4. Explain how to cut a bird's mouth or seat.
5. Describe the procedure for determining run, rise, and rafter length from a working drawing.
6. Explain why a pattern rafter should be used in cutting a number of common rafters.
7. Identify the starting point for erecting gable rafters and hip rafters.
8. Explain how to use a framing square for calculating and cutting common rafters.
9. Reference FHA specifications and local building codes regarding common rafters.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.5 Cut and install common, valley, hip, and jack rafters.

**TASK:**

8.5.2 Cut and install valley rafter and valley jack rafters.

**PERFORMANCE STANDARD:**

Valley rafter must fit between ridge, base, and common rafters with no gaps; top of common rafters and center of valley must be aligned; end of valley rafter projection must be aligned with common and/or hip rafters; and rafter must be nailed in place. Longest valley jack rafter must be same as common rafter except for side cut at bottom; joining surfaces on side cuts must fit together tightly; and hip and valley rafter must not be bowed.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, circular saw, common and/or hip rafters in place, nails, plans and specifications, straight stock.

**PERFORMANCE STEPS:**

VALLEY RAFTER

1. Determine rafter specifications from plans.
2. Calculate unit of rise and units of run from common and/or hip rafters.
3. Calculate length of valley rafter from rafter tables.
4. Establish crown of straight stock.
5. Lay out and mark side cuts of top of rafter valley.
6. Subtract one half of 45 degree thickness of ridgeboard from side cut of valley rafters.

7. Lay out and mark top plumb cut of valley rafter.
8. Measure height of common rafter from seat cut to top of common rafter.
9. Transfer common rafter height to valley rafter.
10. Lay out and mark bird's mouth cut for plate.
11. Lay out and mark valley rafter projection to match common rafters.
12. Measure and cut valley rafter.
13. Nail valley rafter in place.
14. Check valley rafter alignment with top and ends of common and/or hip rafters.

VALLEY JACK RAFTERS

1. Determine rafter specifications from plans.
2. Calculate unit of rise from common rafters.
3. Calculate common difference and length of jacks from rafter tables.
4. Establish crown of straight stock.
5. Lay out and mark side cuts for jacks on edge of rafter.
6. Subtract one half of 45 degree thickness of valley rafter from jack rafter.
7. Lay out and mark top cut from common rafter.
8. Measure and cut first jack rafter pair.
9. Subtract common difference from first jack rafter pair.
10. Lay out, mark, and cut remaining jack rafter pairs.
11. Nail jacks to valleys in pairs.
12. Check alignment of valley jack rafter with common and valley rafters.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify valley rafters and valley jack rafters on working drawings.
3. Identify fastening requirements for valley rafters and valley jack rafters.
4. Explain how to allow for ridge thickness.
5. Differentiate between valley rafter and valley jack rafters.
6. Define roof pitch or slope.
7. Explain how to use framing square for calculating and marking cuts.
8. Reference FHA specifications and local building codes regarding valley and valley jack rafters.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.5 Cut and install common, valley, hip, and jack rafters.

**TASK:**

8.5.3 Cut and install hip rafter and hip jack rafters.

**PERFORMANCE STANDARD:**

Hip rafter must fit ridge, top plate, and common rafters with no gaps; top of common rafters and center of hip rafter must be aligned; end of hip rafter projection must be aligned with common rafter; and hip rafter must be nailed and located as specified on plans. Hip jack rafters must fit hip rafters in pairs with no gaps and must be spaced according to plans; top and ends of jacks must be aligned with common and hip rafters.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, circular saw, common rafters in place, nails, plans and specifications, straight stock

**PERFORMANCE STEPS:**

HIP RAFTER

1. Determine rafter specifications from plans.
2. Calculate unit of rise and units of run.
3. Calculate length of hip rafter with rafter tables.
4. Establish crown of straight stock.
5. Lay out and mark side cuts of hip rafter with framing square.
6. Lay out and mark plumb cuts of hip rafter.
7. Measure and mark height of common rafter from seat cut to top of rafter.
8. Transfer height of common rafter to hip rafter.
9. Lay out bird's mouth on hip rafters.
10. Subtract drop of hip rafter from bird's mouth.
11. Lay out projection of hip rafter.
12. Cut hip rafter.
13. Nail rafter in place.

HIP JACK RAFTERS

1. Determine rafter specifications and spacing from plans.
2. Calculate unit of rise from common rafters.
3. Calculate common difference in length of hacks from rafter tables.
4. Establish crown of straight stock.
5. Lay out and mark side cuts for jacks on edge of rafter.
6. Subtract one half of 45 degree thickness of hip rafter from jack rafter.
7. Square line across rafter and mark center point.
8. Lay out and mark seat cut and projection from common rafter.

9. Measure and cut first jack rafter pair.
10. Subtract common difference of first jack rafter pair to second jack rafter pair.
11. Lay out, mark, and cut remaining jack rafter pairs according to method in step 10.
12. Nail jacks to hips in pairs.
    Note: Do not bow hip rafters.
13. Check alignment of jack rafters with common and hip rafters.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify valley jack, hip jack, and cripple jack rafters from working drawings.
3. Identify fastening requirements for jack rafters.
4. Explain how to allow for ridge thickness.
5. Define roof pitch or slope.
6. Explain how to use framing square for calculating and marking cuts.
7. Reference FHA specifications and local building codes regarding hip and hip jack rafters.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.6 Cut and install a ridgeboard.

**TASK:**

8.6.1 Cut and install a ridgeboard.

**PERFORMANCE STANDARD:**

Ridgeboard must be straight and level and braced when required; rafter crowns must be turned upward and spaced according to plans.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, ceiling joists in place, circular saw, nails, plans and specifications, rafters, straight stock.

**PERFORMANCE STEPS:**

1. Determine length of ridgeboard from plans.
2. Lay out and mark rafter spacing on ridgeboard.
3. Measure and cut ridgeboard.
4. Nail two end rafters to one side of ridgeboard.

5. Lift ridgeboard and attach to two other end rafters to opposite side of ridgeboard.
6. Nail all four rafters at base of rafter.
7. Plumb and brace rafter-ridgeboard assembly.
8. Adjust as necessary.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify common dimensioned lumber used for ridgeboards.
3. Explain the purpose of a ridgeboard.
4. Determine ridge length from working drawings.
5. Define the term "crown" and why it is placed on top of ridge.
6. Identify techniques for connecting two ridgeboards together.
7. Reference FHA and local building codes regarding ridgeboards.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.7 Frame roof openings and gable ends.

**TASK(S):**

8.7.1 Frame roof openings.
8.7.2 Frame gable ends.

**TASK:**

8.7.1 Frame roof openings.

**PERFORMANCE STANDARD:**

The openings must be square and within size specifications (+ or -) 1/16". All frame members and tail rafters must be cut to required length (+ or -) 1/16" and installed straight and plumb with the required fastening pattern.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, circular saw, nails, plans and specifications, straight stock.

**PERFORMANCE STEPS:**

1. Determine location and size of opening from plans.
2. Lay out width of opening on both ridge and top plate.
3. Measure and mark trimmer.

4. Cut trimmer rafters.
5. Nail trimmer rafters.
6. Lay out length of opening on rafters.
7. Measure and mark headers.
8. Mark location of tops of double headers.
9. Cut headers.
10. Bevel tops for chimney openings.
11. Check plans for plumb or right angle rafter set.
12. Nail headers.
13. Measure and mark tail rafters.
14. Cut tail rafters.
15. Nail tail rafters at spacing specified on plans.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify roof openings for chimneys, skylights, or dormers from working drawings.
3. Identify materials used for roof openings.
4. Explain how to use framing square.
5. Define the terms "roof pitch," "tail rafter," "plumb," "right angle," and "header."
6. Reference FHA specifications and local building codes regarding roof openings.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.7 Frame roof opening and gable ends.

**TASK:**

8.7.2 Frame gable ends.

**PERFORMANCE STANDARD:**

Top cuts of gable studs must fit tightly against rafters; studs must have same slope as roof and must be plumb and according to plans and specifications.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, double plate in place, nails, plans and specifications, portable circular saw, straight stock, T-bench

**PERFORMANCE STEPS:**

1. Check plans and specifications.

2. Square line across end wall double plate directly below center of gable.
3. Measure half of window or louver opening size on each side of center line and mark location for first two studs.
4. Lay out spacing for all studs according to plans and specifications.
5. Cut and install two full-length studs.
6. Plumb and mark length of all shorter studs.
7. Cut studs.
8. Nail studs flush with outside of plates and rafters.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify gable end details in a working drawing.
3. Identify fastening requirements for gable ends.
4. Define the term "roof pitch."
5. Explain how to use a framing square.
6. Identify techniques for cutting notches in studs.
7. Explain why stud placement is important.
8. Reference FHA specification and local building codes regarding gable ends.
9. Identify a snub gable.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.8 Cut and install collar ties.

**TASK:**

8.8.1 Cut and install collar ties.

**PERFORMANCE STANDARD:**

Top of collar ties/beams must be slightly below tops of rafters and collar ties/beams must be of size and spacing specified on plans.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, framed roof, nails, plans and specifications, straight stock

**PERFORMANCE STEPS:**

1. Determine size, spacing, and height of collar beams from plans and specifications.
2. Mark height on one side of rafters.
3. Chalk line between marks.

4. Mark height on other side of rafters.
5. Chalk line between marks.
6. Measure span across opposite marks.
7. Cut one collar to span measurement for specified rafter pairs.
8. Nail collars in places marked on rafters.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify collar ties from working drawings.
3. Explain why spacing and position requirements may be different for collar ties with and without an attic space included in the plans.
4. Explain how to use a framing square.
5. Identify roof pitch and styles of roofs.
6. Reference FHA specification and local building codes regarding collar ties or beams.
7. Identify the function of a collar tie or beam.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.9 Lay out, build, and install roof trusses.

**PERFORMANCE STANDARD:**

All members of truss must form rigid framework for load support over span; tail cuts must be plumb; and peak and intermediate gussets must be nailed to both sides of truss. Trusses must be secured to structure, plumb, and straight (+ or -) 1/16".

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, connector plates, ladder, nails, plans and specifications, plywood for gussets, portable circular saw, straight stock, T-bench

**PERFORMANCE STEPS:**

1. Check plans and specifications for building dimensions.
2. Calculate span, run, rise, and roof pitch.
3. Snap chalk lines for two top chords and one bottom chord.
4. Lay out truss pattern.
5. Calculate plumb cut and tail cuts for top and bottom chords.
6. Cut top chords.
7. Cut bottom chord.
8. Calculate length of tension webs.
9. Cut tension webs.

10. Calculate length of compression webs.
11. Cut compression webs.
12. Assemble truss and pin with nails, truss clips, or connector plates.
13. Cut peak and intermediate gussets for both sides of truss.
14. Nail gussets to peak and bottom chord on both sides of truss.
15. Mark top plates of walls for position of truss.
16. Raise truss onto structure.
17. Position truss on top plate mark and nail.
18. Brace as needed.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the following truss terms: (a) top chord, (b) bottom chord, (c) tail, (d) web, (e) gussets or plates, (f) camber, and (g) pattern truss.
3. Identify types of roof trusses from blueprints or drawings.
4. Identify tools, equipment, and materials needed to lay out a roof truss.
5. Explain how to use a framing square to lay out the top chord.
6. Identify truss specifications from working or detail drawing.
7. Explain why assistance is needed in erecting and fastening prefabricated trusses.
8. Explain why trusses are often used instead of rafters in modern residential construction.
9. Reference FHA specifications and local building codes regarding roof trusses.

**UNIT: 8 FRAMING ROOF AND CEILING**

**LEARNING OUTCOME:**

8.10 Install roof decking/sheathing.

**TASK:**

8.10.1 Install roof decking/sheathing.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, circular saw, framed roof, ladder, nails, scaffold, sheathing

**PERFORMANCE STEPS:**

1. Check roof frame construction and nailing patterns.
2. Erect scaffold.
3. Measure and strike chalk line 4 feet up from end of rafters at each end of roof.
4. Lay top of first row of sheathing on chalk line.
5. Center end joints on rafter.
6. Nail sheathing into rafters.
7. Cut half sheet for second row.
8. Nail second row, breaking joints.
9. Continue procedure until roof is sheathed.
10. Cut excess sheathing along hips.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Explain why a chalk line is necessary to install roof decking.
3. Identify the fastening pattern for decking.
4. Identify materials that can be used for roof decking or sheathing.
5. Reference FHA specification and local building codes regarding roof decking and sheathing.
6. Identify adhesives that can be used for decking or sheathing a roof.
7. Describe the different styles of roofs.

**UNIT: 9 INSTALL ROOF**

**LEARNING OUTCOME:**

9.1 Apply roofing felt paper.

**TASK:**

9.1.1 Apply roofing felt paper.

**PERFORMANCE STANDARD:**

Felt must be tight, with 2 inch lap at horizontal joints, and 4 inch lap at end joints, and nailed every 16 to 24 inches across top, every 12 inches across middle, and every 4 inches across sides and bottom.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, galvanized roofing nails, ladder, plans and specifications, roofing felt, sheathed roof

**PERFORMANCE STEPS:**

1. Check plans and specifications for size and weight of felt paper.
2. Inspect sheathing for complete nailing patterns and protruding nails.
3. Hammer any protruding nails into sheathing.
4. Clean sheathing of foreign materials.
5. If the roof has a valley, a strip of felt paper must be installed lengthwise down the valley before installing the horizontal strips.
6. Measure, cut, and roll roofing felt to length of roof, working from bottom to top on all roof surfaces.
7. Roll felt across edge of roof allowing 1 inch overhand at lower edge.
8. Nail every 16 to 24 inches across top.
9. Nail every 12 inches across middle.
10. Nail every 4 inches across sides and bottom.
11. Roll subsequent rows with 2 to 4 inch overlap.
12. Measure, cut, roll, and nail remaining felt.
13. Overlap peaks.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify types of roofing felt paper.
3. Explain the purpose of roofing felt.
4. Define roof line and lap line.
5. Reference FHA specifications and local building codes regarding roof felt or underlayment.
6. Identify the types of roof designs.

**UNIT: 9 INSTALL ROOF**

**LEARNING OUTCOME:**

9.2 Install asphalt composition shingle.

**TASK:**

9.2.1 Install asphalt composition shingle.

**PERFORMANCE STANDARD:**

Shingles must be flush to surface with shingle pattern and nailing pattern complete according to manufacturer's specifications.

Ridge cap must be straight and overlapped equally on each side of ridges; and all exposed nails must be covered with sealant.

TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):

Standard tool kit, composite strip shingles, galvanized roofing nails, ladder, manufacturer's specifications, sealant, sheathed and flashed roof

PERFORMANCE STEPS:

INSTALL COMPOSITE STRIP SHINGLES

1. Strike chalk line 1 inch less than width of shingles from height.
2. Strike subsequent parallel chalk lines on weather exposed height.
3. Strike vertical chalk lines according to manufacturer's specifications allowing for 1 inch overhang.
4. Position and nail starter shingle according to manufacturer's specifications.
5. Continue nailing as specified until first row is complete.
6. Cut first shingle for second row according to manufacturer's specifications.

INSTALL COMPOSITE SHINGLES ON RIDGE CAP

1. Cut shingles into individual tabs.
   Note: In cold weather, shingles should be warmed to prevent breakage.
2. Strike chalk lines according to manufacturer's specifications.
3. Cap gable roof:
   a. Position first shingle tab opposite weather side on edge of ridge.
   b. Nail with two roofing nails above exposure line.
   c. Position next shingle tab along chalk line overlapping previous shingle leaving exposure stipulated in manufacturer's specifications.
   d. Nail with two roofing nails above exposure line.
   e. Continue to position and nail shingles as specified until ridge is complete.
4. Cap hip roof:
   a. Position first shingle tab along chalk line at bottom of hip.
   b. Cut edges of first shingle to conform with roof.
   c. Nail with two roofing nails above exposure line.
   d. Position next shingle tab along chalk line overlapping previous shingle according to manufacturer's specifications.
   e. Nail with two roofing nails above exposure line.
   f. Continue to position and nail shingles as specified until hip is complete.
5. Facenail final shingle.
6. Cover nailheads with sealant.

ENABLING OBJECTIVES:

1. Explain the relevant safety practices and procedures.
2. Define the following roofing terms: (a) shingle, (b) bundle, (c) square, (d) starter strip, (e) course or run, (f) exposure, and (g) cap tab.
3. Explain how to estimate the number of bundles required for a roof frame.
4. Identify types of asphalt shingles and required fastening patterns.
5. Explain why assistance is needed to apply asphalt shingles.
6. Describe how to apply asphalt sealer.
7. Reference FHA specifications and local building codes regarding asphalt shingles.

UNIT: 9 INSTALL ROOF

LEARNING OUTCOME:

9.3 Install and caulk metal flashing.

TASK:

9.3.1 Install and caulk metal flashing.

PERFORMANCE STANDARD:

Flashing must extend 5 inches up chimney face, 5 inches down onto shingles, and 4 inches beyond chimney sides; flashing must be secured with galvanized metal wedges and all joints where flashing meets masonry must be sealed. Flashing must be flush to surface and without nail holes.

TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):

Standard tool kit, aluminum roll flashing, galvanized metal wedges, ladder, metal brake, plans and specifications, galvanized roofing nails, sealant, sheathed roof, tip snips.

PERFORMANCE STEPS:

CHIMNEY FLASHING

1. Check plans and specifications.
2. Cut and bend base flashing for front face of chimney so that flashing extends down onto shingles at least 5 inches, up chimney at least 5 inches, and beyond chimney sides at least 4 inches.
3. Cut step flashing in 8 inch squares for chimney sides.
4. Bend step flashing at right angles so that 5 inches extends up chimney face and 3 inches extends onto roof deck.

5. Install base flashing on front face of chimney bending extensions around corners.
6. Install individual step flashing squares along both sides of chimney as roofing shingles are laid.
7. Bend flashing to fit around lower corners of chimney.
8. Cut and bend counter flashing for lower face of chimney from one piece of flashing, allowing extra metal to bend around sides of chimney.
9. Insert counter flashing into mortar joint.
10. Secure with metal wedges.
11. Cut and bend counter flashing for sides of chimney to allow roof slope..
12. Insert upper edge of flashing into mortar joint and secure with metal wedges.
13. Continue to install counter flashing up sides and across back of chimney.
14. Seal joints where flashing meets masonry.

VALLEY FLASHING

1. Strike chalk line half width of flashing from center of valley.
2. Measure and cut flashing to valley length including overlap.
3. Brake flashing at half width.
4. Set flashing and align edge with chalk line.
5. Nail along edges.
   CAUTION: NAIL HEADS MUST NOT PIERCE FLASHING.
6. Fold flashing over ridge.
   Note: Join strips by overlapping 12 inches and securing with asphalt cement.
7. Seal edges.

ENABLING OBJECTIVES:

1. Explain the relevant safety practices and procedures.
2. Explain the purpose of metal flashing.
3. Identify flashing material by type and thickness.
4. Identify fastening patterns and sealers used for metal metal flashing.
5. Demonstrate cutting of sheet metal and aluminum flashing for valleys and roof openings.
6. Reference FHA specifications and local building codes regarding metal flashing.

UNIT: 9 INSTALL ROOF

LEARNING OUTCOME:

9.4 Install eaves, downspouts, and ridge vents.

**TASK(S):**

9.4.1 Install eaves drip edge.
9.4.2 Install downspouts.
9.4.3 Install ridge vents.

**TASK:**

9.4.1 Install eaves drip edge.

**PERFORMANCE STANDARD:**

Eave drip edge must be flush with the deck, with a 3/4" overhang and the overhang must be bent downward at an approximate 45 degree angle.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, drip edge, galvanized roofing nails, ladder, plans and specifications, sheathed roof, tin snips

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Inspect and prepare eave or rake where drip edge is to be attached.
3. Measure length of eave or rake.
4. Measure cut and position drip edge along eave.
5. Lay first strip of drip edge at corner; make sure there is at least 3/4" overhang.
6. Fasten drip edge in place and bend outer edge of drip edge downward approximately 45 degrees.
7. Make adjustments to ensure that drip edge is flush with deck and secured.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Describe the function of the drip edge.
3. Identify flashing material by type and thickness.
4. Identify drip edge with gutter hanging lip.
5. Identify fastening patterns and sealers used for metal flashing.
6. Reference FHA specifications and local building codes regarding eave drip edge.

**LEARNING OUTCOME:**

9.4 Install eaves, downspouts, and ridge vents.

**TASK:**

9.4.2 Install downspouts.

**PERFORMANCE STANDARD:**

Downspout must run from gutter to drainage system in ground; must be secured to building, and free of leaks.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, downspout, downspout elbows, eave tube, electric drill and bits, fasteners, liquid solder, plans and specifications, pop rivet gun, pop rivets, tin snips

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Locate position of eave tube on gutter.
3. Drill 1/8" inch holes through edges of eave tube and gutter.
4. Cut hole in bottom of gutter with snips to inside perimeter of eave tube.
5. Attach eave tube to bottom of gutter with pop rivets through holes.
6. Bead liquid solder around top of eave tube.
7. Measure length of downspout needed from eave tube to drainage system.
8. Cut length of downspout.
9. Position downspout over eave tube.
   Note: If soffit overhang holds gutter away from building, return downspout to wall using 45 degree elbows and short lengths of downspout.
10. Return downspout to wall using 45 degree elbows and short lengths of downspout for gutters on soffit overhang.
11. Secure downspout to wall with fasteners.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the styles, shapes, and sizes of downspouts.
3. Describe the function of the eave tube.
4. Identify types and sizes of pop rivets.
5. Identify sealants for downspouts.
6. Reference FHA specification and local building codes regarding downspouts.

UNIT: 9 INSTALL ROOF

LEARNING OUTCOME:

9.4 Install eaves, downspouts, and ridge vents.

TASK:

9.4.3 Install ridge vents.

PERFORMANCE STANDARD:

Ridge vent must be aligned with ridge and must allow air to circulate in rafters.

TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):

Standard tool kit, circular saw, end caps, galvanized roofing nails, ladder, manufacturer's specifications, portable circular saw, ridge vent, sheathed and shingled roof, slip connector

PERFORMANCE STEPS:

1. Remove shingles from ridge.
2. Cut sheathing back 1 inch from each side of peak.
3. Strike chalk line 3 inches from peak.
4. Set ridge vent(s) along chalk line.
5. Cut last ridge vent to length.
6. Connect ridge vents with slip connector.
7. Plug ends of ridge vents with end caps.
8. Nail ridge vents according to manufacturer's specifications behind splash guard.

ENABLING OBJECTIVES:

1. Explain the relevant safety practices and procedures.
2. Identify the styles, shapes, and sizes of ridge vents.
3. Describe the function of ridge vents.
4. Identify sealants for ridge vents.
5. Reference FHA specifications and local building codes regarding ridge vents.
6. Describe the importance of air circulation through rafter and attic areas.

UNIT: 10 FINISHING EXTERIOR

LEARNING OUTCOME:

10.1 Install exterior sheathing and siding.

**TASK(S):**

10.1.1 Install exterior sheathing.
10.1.2 Install exterior siding.

**TASK:**

10.1.1 Install exterior sheathing.

**PERFORMANCE STANDARD:**

Siding must be level, plumb, with bottom edge 1/4" below sill, horizontal joints must be sealed.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, circular saw, galvanized nails, manufacturer's instructions, panel siding, plans and specifications, sealant, sheathed exterior wall

**PERFORMANCE STEPS:**

1. Check plans and specifications for siding specifications.
2. Read manufacturer's installation instructions.
3. Establish size of first panel to maintain symmetry of pattern.
4. Set first panel into position with edges located over center of framing members.
5. Tack into place with bottom edge at least 1/4" below wood sill.
6. Check for plumb.
7. Level first panel.
8. Nail panel in place.
9. Continue installing panels around building perimeter.
10. Seal horizontal joints.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify types of metal, vinyl, and wood siding.
3. Identify types of fasteners, fastening patterns, and adhesives used to install exterior sheathing.
4. Describe the procedures for installing metal, vinyl, and wood siding.
5. Explain why siding materials should be handled carefully.
6. Identify the types of panel for exterior applications.
7. Describe how to install battens.

**LEARNING OUTCOME:**

10.1 Install exterior sheathing and siding.

**TASK:**

10.1.2 Install exterior siding.

**PERFORMANCE STANDARD:**

Siding must be level, evenly spaced, securely attached to framing; nails must be at least 8 penny; and all exposed edges must be primed.

**TOOLS, RESOURCES, EQUIPMENT, AND SITUATION(S):**

Standard tool kit, circular saw, exterior sheathed wall, galvanized nails, plans and specifications, primed wood siding material, primed wood trim material, scaffold, straight stock, wood shingles

**PERFORMANCE STEPS:**

BEVEL SIDING

1. Check plans and specifications.
2. Fasten primed wood starter strip to sill plate.
3. Cut corner boards.
4. Cut 2 inch wedges.
5. Install corner boards.
6. Install wedges at corner boards and over studs at ends of siding lengths.
7. Lay out story pole to establish equal exposed space for siding.
8. Nail first course of siding with bottom edge 1/4 inch below starter strip.
9. Use spacer block to locate second course.
10. Overlap second and all succeeding courses.
11. Nail second and succeeding courses through siding and sheathing into framing member until wall is complete.

WOOD SHINGLES

1. Check plans and specifications for coursing and details.
2. Read manufacturer's installation instructions.
3. Strike chalk line on foundation wall for bottom course.
4. Install corner boards, if necessary.
5. Lay out story pole for coursing.
6. Nail first course with butts level.
7. Mark location of butt line for succeeding courses.

8. Nail second course directly over first course covering joints.
9. Continue procedure for succeeding courses.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the types of metal, vinyl, and wood siding.
3. Identify the types of fasteners, fastening patterns, and adhesives used to install exterior siding.
4. Explain why siding material should be handled carefully.
5. Identify wood preservatives and their applications.

**UNIT: 10 FINISHING EXTERIOR**

**LEARNING OUTCOME:**

10.2 Frame a boxed cornice.

**TASK:**

10.2.1 Frame a boxed cornice.

**PERFORMANCE STANDARD:**

Fascia boards, soffits or planciers (horizontal or sloping), lookouts, ledgers, and frieze boards must be cut and installed to specifications (+ or -) 1/16". Fascia boards must be joined with required end and corner joints for a tight fit (+ or -) 1/16". All cornice members must be fastened using required patterns.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, exposed rafters, galvanized nails, plans and specifications scaffold and straight stock

**PERFORMANCE STEPS:**

1. Check plans and specifications for cornice detail.
2. Place level against bottom edge of two end rafters.
3. Mark where top of level touches sheathing.
4. Strike chalk line between two points.
5. Check line for level.
6. Cut ledger to length.
7. Tack ledgers along length of cornice.
8. Calculate placement and length of lookouts.
9. Cut lookouts.
10. Determine dimensions of corner lookouts.
11. Cut corner lookouts.
12. Remove ledger.
13. Nail lookouts.

14. Raise assembled cornice.
15. Nail ledger to studs.
16. Nail lookouts to rafters.
17. Nail corner lookouts.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify components of a boxed cornice including fascia board, soffit or plancier, lookout, ledger, and frieze board.
3. Identify various types of cornices and rakes.
4. Identify characteristics of building materials used for exterior trim.
5. Describe the function of a cornice.

**UNIT: 10 FINISHING EXTERIOR**

**LEARNING OUTCOME:**

10.3 Install double-hung windows.

**TASK:**

10.3.1 Install double-hung windows.

**PERFORMANCE STANDARD:**

Windows must be installed from the outside. Side jambs must be plumb, frames must be level, and corners must be square (+ or -) 1/16". Windows must be installed so that the sashes operate smoothly and fastened with aluminum or galvanized casing nails approximately 16" O.C. Nails must penetrate well into the rough frame and must be countersunk with a nail set.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, galvanized nails, plans and specifications, shim materials, window unit

**PERFORMANCE STEPS:**

1. Check plans and specifications for window detail.
2. Check window size.
3. Lift window unit into opening.
4. Level, plumb, and shim window unit.
5. Nail window molding or flange to framing at top to hold unit to framing.
6. Check window unit for plumb and level.
7. Nail window unit to framing.
8. Check opening operation of window and adjust as necessary.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify double-hung, casement, and fixed windows with metal or wood frames.
3. Identify the components of a double-hung window.
4. Explain how to avoid breaking or damaging windows.1
5. Explain the purpose of wedge blocks.
6. Reference FHA and local building codes regarding window installation.
7. Identify thermopane windows, twin glazed windows, and storm windows.

**UNIT: 10 FINISHING EXTERIOR**

**LEARNING OUTCOME:**

10.4 Install exterior doors.

**TASK:**

10.4.1 Install exterior doors.

**PERFORMANCE STANDARD:**

Doors must be installed with plumb jambs, level sills, and square corners (+ or -) 1/16". Hung doors must operate smoothly, and the frame must be fastened with aluminum or galvanized casing nails 16" O.C. The nails must penetrate well into the rough frame and must be countersunk with a nail set.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, door jamb with dadoes, door/with hinges, plans and specifications, shims, straightedge, straight stock

**PERFORMANCE STEPS:**

Install exterior door jamb

1. Check plans and specifications for door jam detail.
2. Check rough opening dimensions.
3. Measure,nark, and cut two side jambs to height with dadoes for head level.
4. Measure, mark, and cut head jamb to width.
5. Nail side jambs into head jamb.
6. Cut temporary spacer piece width of inside opening as measured at head jamb.
7. Set jamb unit in position in rough opening with spacer at bottom.

8. Plumb edge and face with shims on both sides at head and sill to hold jamb in place.
9. Insert shims near hinge and knob locations.
10. Maintain position and nail jamb to frame.
11. Check for square.

Hand door

1. Check plans and specifications for door detail.
2. Place wedge in threshold position.
3. Set door in jamb opening.
4. Wedge door in place from latch side.
5. Shim door bottom to establish head clearance.
6. Check for fit.
7. Mark approximate hinge locations on door and jamb.
8. Check for clearances.
9. Remove door.
10. Complete lay out and mark exact hinge locations on door and jamb.
11. Chisel gains.
12. Set hinges in place.
13. Remove hinge pins and secure leaves to jamb and door with two screws.
14. Test-hang door inserting pins.
15. Adjust for clearance and operation.
16. Install remaining screws in hinges.
17. Check for operation.
18. Install threshold.
19. Cut bottom of door if necessary.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify exterior doors by size, type, direction of opening, and design from a door schedule.
3. Identify the components of an exterior door assembly (door and door frame).
4. Explain how to install lock sets.
5. Describe how to hang steel door.
6. Identify weatherstripping for exterior doors.
7. Reference FHA specifications for door specifications.

**UNIT: 10 FINISHING EXTERIOR**

**LEARNING OUTCOME:**

10.5 Install exterior trim.

**TASK:**

10.5.1 Install exterior trim.

**PERFORMANCE STANDARD:**

Molding or trim must be cut to required lengths (+ or -) 1/16" and installed with required fasteners and tight joints.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, casing material, circular saw, galvanized nails, plans and specifications, scaffold, soffit materials

**PERFORMANCE STEPS:**

Casing

1. Check plans and specifications.
2. Measure horizontal and vertical opening dimensions.
3. Measure and mark side casing members to show "reveal".
4. Cut side casing members with heads exposed.
5. Nail side casing.
6. Measure and mark top casing member.
7. Cut top casing member.
8. Align top casing with side casing.
9. Nail top casing.
10. Nail remainder of casing.
11. Set nails.

Fascia

1. Check plans and specifications for facia detail.
2. Measure for length of fascia.
3. Check rafter ends for alignment.
4. Cut rafter ends if necessary.
5. Cut fascia to length.
6. Cut joints of fascia boards at 45 degree on plumb cut.
7. Nail fascia to rafter ends.
8. Check position and shim if necessary.
9. Set nails.

Soffit

1. Check plans and specifications for soffit detail.
2. Measure for length and width of soffit.
3. Cut soffit piece to desired length and width.
4. Butt joints of two soffit lengths at 45 degree.
5. Fit soffit between fascia and wall in fascia groove.
6. Nail soffit to framing.
7. Set nails.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.

2. Identify exterior trim and molding used on doors, windows, and cornices.
3. Explain how to make miter joints in molding and trim.
4. Identify types of material for trim work.
5. Describe the classifications for lumber.

**UNIT: 11 FINISHING INTERIOR**

**LEARNING OUTCOME:**

11.1 Install insulating batting in walls, ceilings, and floors.

**TASK:**

11.1.1 Install insulating batting in walls, ceilings, and floors.

**PERFORMANCE STANDARD:**

Batt insulation must be recessed 3/4 inch; staples must be driven flush; faces of studs and joists must be free of insulation; and R factor of insulation used must comply with plans and specifications.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, batt insulation with vapor barrier, plans and specifications, staple gun, staples

**PERFORMANCE STEPS:**

1. Check R factor of insulation on plans and specifications.
2. Measure height of wall between plates/or length for ceiling and floors.
3. Cut insulation longer than measured length to seal ends at plates.
4. Recess insulation 3/4 inch between studs/joists.
5. Staple edge of insulation to inside of studs/joists.
6. Recess insulation 3/4 inch on bottom and top plates.
7. Staple insulation to top and bottom or side plates.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify "R" ratings.
3. Describe the function of the vapor barrier.
4. Reference FHA specification and local building codes for insulation requirements.
5. Identify the types of insulation material available and their applications, advantages and disadvantages.

UNIT: 11 FINISHING INTERIOR

LEARNING OUTCOME:

11.2 Cut and install furring strips.

TASK:

11.2.1 Cut and install furring strips.

PERFORMANCE STANDARD:

Furring strips must be cut to required length (+ or -) 1/16" and installed level as a nailing base for the suspended ceiling or interior wall. The furring strips must be attached securely with the required fasteners.

TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):

Standard tool kit, furring strips, nail/fasteners, plans and specifications

PERFORMANCE STEPS:

1. Check plans and specifications.
2. Locate placement of furring strips.
3. Cut strips to length.
4. Apply adhesive if required.
5. Fasten strips to wall/ceiling at specified location.
6. Continue procedure until all furring strips have been installed.

ENABLING OBJECTIVES:

1. Explain the relevant safety practices and procedures.
2. Determine the lengths and spacing of furring strips from working drawings.
3. Identify fasteners and patterns required for furring.
4. Explain the purpose of furring strips.
5. Reference FHA specifications and local building codes regarding furring strips.
6. Identify the types of adhesives available and how to apply adhesives.
7. Describe the type of woods used for furring.

UNIT: 11 FINISHING INTERIOR

LEARNING OUTCOME:

11.3 Cut and install solid wood paneling.

**TASK:**

11.3.1 Cut and install solid wood paneling.

**PERFORMANCE STANDARD:**

Wall panels must fit corners; must be plumb; must butt with no gaps; and must be located as specified on plans and specifications.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, furring strips, nails, panel adhesive, plans and specifications, shim shingles, wall paneling

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Lay out and mark pattern.
3. Measure and cut furring strips if necessary.
4. Nail furring strips in place if necessary.
5. Shim for flush surface if necessary.
6. Measure and cut panel.
7. Place first panel in corner.
8. Check for plumb.
9. Scribe and fit panel.
10. Glue first panel.
11. Nail first panel.
12. Butt second panel to first panel.
13. Lay out window, door, and outlet box openings.
14. Continue procedure until all wall panels have been installed.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify materials suitable for solid wood paneling.
3. Identify board-and-batten, shiplap, and tongue-and-groove types of solid wood paneling.
4. Identify nominal sizes of solid wood paneling.
5. Explain how to calculate the amount of solid wood material needed for a room.
6. Demonstrate cutting of solid wood paneling material.
7. Reference FHA specification and local building codes regarding solid wood paneling.

**UNIT: 11 FINISHING INTERIOR**

**LEARNING OUTCOME:**

11.4 Install and finish drywall board.

TASK(S):

11.4.1 Install drywall board.
11.4.2 Finish drywall board.

TASK:

11.4.1 Install drywall board.

PERFORMANCE STANDARD:

Sheets must be installed with edges centered on wall studs and ceiling joists (+ or -) 1/16". Gaps between joints must not exceed 1/32", and the sheets must be nailed with the required pattern (+ or -) 1". Drywall sheets must be cut accurately (+ or -) 1/8" for openings and electrical outlets or fixtures.

TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):

Standard tool kit, adhesive, drywall, drywall nails, key hole saw, plans and specifications

PERFORMANCE STEPS:

1. Check plans and specifications for location and type of material to be used.
2. Measure length of section to receive drywall.
3. Measure width of section to receive drywall.
4. Cut drywall cutouts.
5. Measure locations of cutouts (outlets, plumbing, etc.).
6. Cut holes for cutouts.
7. Apply adhesive to studs.
   Note: Do not use adhesive on metal studs.
8. Position drywall so that vertical joints fall over stud centers, butting factory edges when possible.
9. Nail drywall every 8 inches along vertical edges.
10. Nail top and bottom at each wall stud.
11. Double nails at top center and bottom center of each wall stud.

ENABLING OBJECTIVES:

1. Explain the relevant safety practices and procedures.
2. Identify drywall or sheetrock sizes used for walls and ceilings.
3. Explain why care must be used in moving, nailing, and cutting drywall.
4. Explain the advantages of drywall over plaster and lath construction.
5. Identify the fasteners and nailing pattern used for installing drywall.
6. Identify adhesives for drywall board.

**UNIT: 11 FINISHING INTERIOR**

**LEARNING OUTCOME:**

11.4 Install and finish drywall board.

**TASK:**

11.4.2 Finish drywall board.

**PERFORMANCE STANDARD:**

All joints, seams, and nail/screw heads must be covered and surfaces sanded smooth.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, corner beading, drywall finishing tool, joint compound, plans and specifications, sandpaper, sealer, seam tape

**PERFORMANCE STEPS:**

1. Install external corner bead.
2. Apply thin coat of joint compound in horizontal ream.
3. Place joint tape into horizontal seams.
4. Press tape into joint compound.
5. Apply coat of joint compound over tape.
6. Repeat steps #3-5 for corners.
7. Coat nail/screw heads and corner beads.
8. Allow joint compound to dry.
9. Sand joint compound.
10. Apply second coat to all joints, seams and nail/screw heads.
11. Allow drying time and fine sand.
12. Apply third coat if needed and repeat steps #10 and 11.
13. Apply sealer coat of finish to entire surface.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify tools for drywall finishing.
3. Describe the types of joint compounds available and their limitations.
4. Identify grits of abrasives for sanding/finishing drywall.
5. Explain how to patch a damaged area.
6. Identify the types of sealers for drywall.
7. Describe procedure for stipled or rough surface finishes.

**UNIT: 11 FINISHING INTERIOR**

**LEARNING OUTCOME:**

11.5 Install interior doors and door lock sets.

**TASK(S):**

11.5.1 Install interior doors.
11.5.2 Install interior door lock sets.

**TASK:**

11.5.1 Install interior doors.

**PERFORMANCE STANDARD:**

Door assemblies must be installed with plumb jambs, level sills, and square corners (+ or -) 1/16". Hung doors must operate smoothly, and the frame must be fastened with required fasteners and pattern 16" O.C. Casing nails must penetrate well into wall frame and must be countersunk with nail set.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, door unit, hardware, manufacturers's specifications, plans and specifications

**PERFORMANCE STEPS:**

Standard door

1. Determine type and size of jambs and door from plans and specifications.
2. Measure and cut head jamb to opening width.
3. Measure and cut side jambs to opening length.
4. Nail jambs and jamb head together.
5. Set assembly into opening.
6. Plumb sides and level head.
7. Shim sides straight and plumb.
8. Nail jamb to studs through shims.
9. Measure and cut door stop material.
10. Nail door stops in place temporarily.
11. Plane door to width beveling lock side toward stop.
12. Place door in opening with wedges under and along sides to hold in position.
13. Mark jamb and door stile simultaneously for hinges.
14. Remove door and mark thickness of hinge at each hinge position on both jamb edge and door edge.
15. Score hinge cutouts using either hinge itself or butt gage.
16. Chisel out all hinge mortises.
17. Secure hinge sections to mortises with wood screws.

18. Hold door in place and install hinge pins.
19. Check door for fit and operation making any necessary adjustments.
20. Install lockset and latch.
21. Check fit against stop and permanently nail stop.

Prehung door - split jambs

1. Check plans and specifications.
2. Separate jamb halves.
3. Place half containing door into opening.
4. Place wedges to center and hold door in place.
5. Adjust shims until jamb is plumb.
6. Nail hinge side through shims.
7. Adjust gap between head jamb and door.
8. Adjust gap between lock side jamb and door.
9. Fit other jamb half into opposite side of opening.
10. Check door operation.
11. Nail casing into studs.
12. Nail door stop.
13. Set nails.

Double-acting door

1. Check plans and specifications.
2. Install hinge floor plate to floor on hinge side of opening.
3. Place door in opening and place shims around perimeter to hold in position.
4. Mark position of floor plate on bottom rail.
5. Check plumb and transfer measurement from jamb to bottom pivot point to top of door and to head jamb.
6. Remove door and mortise top and bottom rails for hinge pivots.
7. Install top plate at point marked on head jamb.
8. Install swivel hinges in mortises.
9. Replace door in opening and engage hinge pivots in plates.
10. Check door operation and adjust if necessary.

Folding door - (accordion)

1. Check plans and specifications.
2. Mark position of top track on head jamb.
3. Install top track as per manufacturer's instructions.
4. Drop plumb line from top track and mark position for bottom track on floor.
5. Install door on tracks.
6. Assemble door unit and pivots as per manufacturer's instructions.
7. Install door on tracks.
8. Check operation and adjust if necessary.
9. Install latch.

Sliding door

1. Check plans and specifications.
2. Assemble door frame as per manufacturer's instructions.
3. Install top track.
4. Drop plumb line from top track and mark position for bottom track on guide.
5. Install bottom track or guide.
6. Install rollers (glides) to doors.
7. Place doors in opening and engage rollers in track as per manufacturer's instructions.
8. Check doors for plumb and fit against jambs and adjust if necessary.
9. Install decorative hardware.

Pocket door

1. Check plans and specifications.
2. Check rough opening for size against requirements for door.
3. Remove wood nailing strips from overhead track.
4. Cut nailing strips to length according to door width.
5. Replace strips on track.
6. Adjust track length to rough opening.
7. Drive nails partially into trimmer studs at height specified in manufacturer's instructions.
8. Hang track on nails.
9. Check level of track and drive nails.
10. Position split jamb and secure to track with screws.
11. Position split stud and secure to track with screws.
12. Plumb both jamb and split stud and secure to floor.
13. Attach roller assemblies to top of door panel as per manufacturer's instructions.
14. Lift door into pocket and engage rollers in track.
15. Adjust door height and plumb with adjusting screws.
16. Install door guides to split jamb.
17. Install rubber bumper to split stud.
18. Check operation of door and make any needed adjustments.
19. Install handle.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the following types of interior doors: hinged, double-action, folding, and sliding.
3. Explain how to cut gains for hinges.
4. Identify the components of an interior door assembly.
5. Identify interior doors by size, type, direction of opening, and design from a door schedule.
6. Reference FHA specifications and local building codes regarding interior doors.

**UNIT: 11 FINISHING INTERIOR**

**LEARNING OUTCOME:**

11.5 Install interior doors and door lock sets.

**TASK:**

11.5.2 Install interior door lock sets.

**PERFORMANCE STANDARD:**

Holes for cylindrical lock sets (knobs), latchtails, and the strike plates must be drilled to the required sizes and locations (+ or -) 1/16". Installed assemblies must allow for the doors to be opened, closed, locked, and unlocked by using knob or key.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, electric drill and bits, installed door unit, lock set, plans and specifications

**PERFORMANCE STEPS:**

1. Check plans and specifications.
2. Wedge door open.
3. Measure up from floor to mark positions for knob.
4. Apply lock set template to door.
5. Mark centers of holes in face and edge of stile.
6. Bore hole from outside through door as specified in manufacturer's instructions.
7. Bore hole in edge of door for latchbolt as per manufacturer's instructions.
8. Score outline of latchbolt plate on door edge.
9. Chisel out mortise for latchbolt plate.
10. Insert latchbolt and screw plate into door.
11. Disassemble knob unit.
12. Slip outside half through hole, sliding machine screws, spindle, and locking bar through holes in latchbolt.
13. Align inside knob half with spindle and locking bar.
14. Tighten screws.
15. Remove door wedge and check operation of assembly.
16. Close door and mark position of strike plate on jamb.
17. Chisel out mortise for strike plate.
18. Screw strike plate into jamb.
19. Check lock set operation.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify lock sets used for exterior and interior doors.

3. Identify drill bits, tools, and materials used to install door lock sets.
4. Reference FHA specifications and building codes regarding interior door lock sets.
5. Identify the parts of a door lock.

**UNIT: 11 FINISHING INTERIOR**

**LEARNING OUTCOME:**

11.6 Cut and install baseboards, trim and molding.

**TASK:**

11.6.1 Cut and install baseboards, trim and molding.

**PERFORMANCE STANDARD:**

All joints must be mitered and free of gaps (+ or -) 1/32". Trim members must be cut to required lengths (+ or -) 1/32". Fasteners must be nailed in the required pattern and countersunk with a nail set.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, baseboard, trim and molding, finishing nails, miter box, plans and specifications

**PERFORMANCE STEPS:**

Base boards

1. Check plans and specifications for base and shoe detail.
2. Locate studs and mark location on floor.
3. Measure baseboards.
4. Cut baseboard.
5. Fit first piece of baseboard where floor and wall meet.
6. Nail baseboard into studs and bottom plate.
7. Bring next piece of base into corner.
8. Cope joint.
9. Miter outside corners.
10. Continue procedure until all baseboard is installed.
11. Cut and fit base to door casing.
12. Set all nails.

Trim

1. Check plans and specifications for type of casing.
2. Lay out casing for sides and head.
3. Cut casings.
4. Square bottoms of side casings.
5. Mark jamb margin on jamb edge with pencil.

6. Measure for head between pencil lines.
7. Cut 45 degree miter on each end of head.
8. Nail head to jamb on pencil line.
9. Hold side casing in place and mark.
10. Cut 45 degree miters on side casing.
11. Fit side casing with block plane.
12. Nail side casing to jamb along pencil line.
13. Nail ends of miters.
14. Nail side casing to wall.
15. Set all nails.

Molding - wall or ceiling

1. Check plans and specifications for molding detail.
2. Measure length of one long wall at ceiling/or a long wall.
3. Measure and cut molding.
4. Nail molding in place.
5. Cope second piece of molding to first piece.
6. Cut and nail molding until room is completed, coping inside corners and mitering outside corners.
7. Set nails.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify the following types of interior trim: base shoe, quarter round, cove molding, bed molding, baseboard, door stool, and picture frame molding.
3. Explain how to miter joints for baseboard, trim, and molding.
4. Reference detail drawings and specifications for applications for various moldings and trim.
5. Describe how to cop joints.
6. Identify types of fasteners for trim work.
7. Describe techniques for filling nail holes and materials available.

**UNIT: 1 FINISHING INTERIOR**

**LEARNING OUTCOME:**

11.7 Install cabinets/vanity.

**TASK:**

11.7.1 Install cabinets/vanity.

**PERFORMANCE STANDARD:**

Cabinets must be level, securely fastened, and tight to surface and any adjacent cabinets.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, cabinets, electric drill and bits, fasteners, manufacturer's instructions

**PERFORMANCE STEPS:**

1. Check plans and specifications for location of cabinets.
2. Measure and mark cabinet position on wall.
3. Drill pilot holes through cabinet.
4. Set cabinet in position.
5. Level cabinet - shim as required.
6. Screw cabinet to surface with wood screws.
7. Check stiles for fit and adjust if necessary.
8. Drill pilot holes at top and bottom edge of side cabinet stiles.
   a. Cabinets are correct if adjacent.
9. Screw cabinet stiles together.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Differentiate between wall cabinet and base cabinet units.
3. Identify the type of fasteners available.
4. Identify the parts of a cabinet.
5. Describe how to use a line level and a plumb line.
6. Describe procedure for installing a recessed medicine cabinet.

**UNIT: 12 CONSTRUCTING STAIRS**

**LEARNING OUTCOME:**

12.1 Lay out, cut, and install a straight-run stringer

**TASK:**

12.1.1 Lay out, cut, and install a straight-run stringer.

**PERFORMANCE STANDARD:**

Stringer must be cut to required length for total rise and run. All risers must be equal. Stringer must be installed straight and plumb must allow for level treads and must be fastened to structure with the required fasteners and pattern.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, framing lumber, nails/fasteners, plans and specifications, rafter square

**PERFORMANCE STEPS:**

1. Check plans and specifications for stairway treatment.
2. Measure distance between floors to obtain rise in inches.
3. Calculate number of risers.
4. Calculate tread width.
5. Multiply tread width by number of steps to obtain optimum total run or stringer length.
6. Lay out stairs on stringer with steel square using previous calculations.
7. Cut out stringer to fit risers and treads.
8. Make plumb cuts and floor cuts.
9. Lift stairs into position.
10. Check for level and plumb and adjust as necessary.
11. Attach stairs to stairwell framing.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Explain how the framing square and tables can be used to lay out a stringer.
3. Identify the following stair construction terms: stringer, riser, tread, unit rise, unit run, total rise, total run, headroom, header, carriage, open stairs, closed stairs, and nosing.
4. Reference the rules regarding rise-run (riser-tread) ratio.
5. Identify dimensioned lumber and wood stockused for stair construction from detail drawings.
6. Identify fasteners and nailing patterns required for stringers.
7. Explain why the relationship between riser and tread length is important in stair design.
8. Demonstrate cutting techniques for stringers.
9. Reference FHA specifications and local building codes regarding stringer layout, construction and riser-tread size.

**UNIT: 12 CONSTRUCTING STAIRS**

**LEARNING OUTCOME:**

12.2 Cut and install risers and treads.

**TASK:**

12.2.1 Cut and install risers and treads.

**PERFORMANCE STANDARD:**

Risers and treads must be cut to required lengths (+ or -) 1/16" and installed securely on the stringers with the required fasteners and pattern. The treads must include the specified overlap or nosing, and joints or edges between risers and treads must not exceed 1/32". The installed risers must be plumb and treads must be level.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, lumber, nails/fasteners, plans and specifications

**PERFORMANCE STEPS:**

1. Check plans and specifications for stair treatment.
2. Select tread lumber.
3. Measure and cut tread lumber to length.
4. Secure tread to stringer.
   a. Check for level.
5. Select riser lumber.
6. Measure and cut riser lumber to length.
7. Position riser to stringer and tread.
8. Check riser for being plumb.
9. Secure riser to stringer and tread.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify wood stock or lumber used for risers and treads.
3. Explain the purpose of a nosing on stair treads.
4. Identify fasteners and patterns required for risers and treads.
5. Reference FHA specifications and local building codes regarding risers and treads.

**PERFORMANCE STANDARD:**

Risers and treads must be cut to required lengths (+ or -) 1/16" and installed securely on the stringers with the required fasteners and pattern. The treads must include the specified overlap or nosing, and joints or edges between risers and treads must not exceed 1/32". The installed risers must be plumb and treads must be level.

**TOOLS, RESOURCES, EQUIPMENT AND SITUATION(S):**

Standard tool kit, circular saw, lumber, nails/fasteners, plans and specifications

**PERFORMANCE STEPS:**

1. Check plans and specifications for stair treatment.
2. Select tread lumber.
3. Measure and cut tread lumber to length.
4. Secure tread to stringer.
   a. Check for level.
5. Select riser lumber.
6. Measure and cut riser lumber to length.
7. Position riser to stringer and tread.
8. Check riser for being plumb.
9. Secure riser to stringer and treads.

**ENABLING OBJECTIVES:**

1. Explain the relevant safety practices and procedures.
2. Identify wood stock orlumber used for risers and treads.
3. Explain the purpose of a nosing on stair treads.
4. Identify fasteners and patterns required for risers and treads.
5. Reference FHA specifications and local building codes regarding risers and treads.

CARPENTRY
STANDARD TOOL KIT

Adjustable wrench
Augers
Ball bearing brace
Block plane
Butt markers
Chalk
Chalk box
Combination square
Coping saw
Crescent wrench
Crosscut saw
Drill
Drill bits
Dryline
Expansion bit
Folding rule
Hacksaw
Hammer
Hatchet
Keyhole saw
Level
Marking gage
Marking scriber
Nailset
Oil
Oilstone
Pencil
Phillips screwdriver
Pinch bar
Plumb bob
Ratchet screwdriver
Screwdriver bit
Scriber
Side cutter
Solid screwdriver
Steel tape
Steel framing square
Tool box
Utility knife
Wood chisels
Wood rasp